THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW

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THE PACIFIC CABLE—AND AFTER.

We briefly referred in our last issue to the interesting meeting which took place at the Mansion House on the 11th inst. under the able Presidency of the Lord Mayor, who was supported on the platform by many well-known public men. Amongst these it was noticeable that the Dominions and the Commonwealth were well represented, and that there was a strong underlying feeling of concord on the subjects which they had met to discuss. In speaking to the resolutions presented to this meeting, it was very clear that with the knowledge born of past experience, and with the hope of future amendment, the spirit of the meeting led straight in one direction—in the direction of State-ownership of cables. But still, "Socialism"—as one is taught to understand it, in a narrow sense—had little, or indeed no guiding part in the opinions expressed. The very apparent wish of those who spoke was that intercommunication between the various parts of our world-wide Empire should be made as facile and free as it could possibly and reasonably be made. The continuation of the friendly relations among kindred peoples surely counts for something! As Sir Edward Sassoon pointed out, a merchant's account for telegrams during the year may be £1,000, more or less; but the individual—the emigrant, whose friends would be interested in his fortunes and whose future, and their futures, as apart from their sympathies, might be concerned—these men and women are surely worthy of consideration, and we gather that in so far as this is "Socialism," the meeting at the Mansion House was distinctly "Socialistic." The Duke of Argyll, whose Governor-Generalship of Canada will always remain memorable there, when moving one of the resolutions spoke somewhat in the sense above indicated, recommending a system of "deferred rates," to the advantage of the poorer classes, as a means of keeping in active life the friendship with those across the seas. *Ne obliviscaris* is a motto not to be forgotten in Canada! Lord Milner's sympathetic remarks on his recent experiences in Canada clearly showed how, owing to the new Post Office reform, British newspapers and magazines were now to be found in the remotest parts of the Dominion, and with what a welcome these were received, drawing together again the ties of almost forgotten kinship.

But farther off lie our Australian cousins; soon to them our words and our thoughts will convey no memory, no meaning; they may easily come to look on any slight news (excepting always, of course, the results of cricket and football matches) which may be exchanged between Great Britain and the Commonwealth as matters of mild indifference. Apparently, as things go, this is almost the position at present. In New Zealand we are glad to believe that this is not the case, and that in that pleasant land, where

energy and comfort go easily hand-in-hand, there is still time left for home memories.

But we have now to consider the practical side of the subject. It is very clear, from long experience, that under the shield of monopolies and State subsidies the cable companies, which at present hold sway, will do nothing, or will only do what little they are absolutely forced to do, and the compelling force under which they have hitherto acted has, of necessity, been either that of State intervention or the dread of it! Let us take the case of the Pacific cable, and let us remember something of that story. How the rates charged per word came tumbling down in front of the inevitable, at one time described as the impossible! A speaker at the Mansion House meeting to which we have referred, by way of stemming the tide, pointed out the supposed loss incurred by the Pacific Cable Board as being £60,000 per annum. Had this gentleman taken the trouble earnestly to investigate these accounts, which are quite open to the public, he might have known, as any man who really cares to know the truth may find clearly stated in last year's accounts, that out of earnings the usual annual sum of £77,544 for interest and sinking fund was provided, and that beyond that sum, which is a capital expense, a special reserve fund of £32,523 was this year, as in the four previous years, set aside for this special reserve, with the small but noticeable difference, that this year's "special" reserve is less than that set aside in any preceding year in the short but interesting life of this, the first State-owned cable of any importance.

To those who care to glance at a small analysis of the position it will be clear from the accounts that of the £30,885 which stands in the Pacific Cable Board account as a deficiency, the proportion of Great Britain's loss is only some £8,500; while Canada, who has stood in the forefront of this battle for many years, stands, as she always has done, side by side with the old country, and pays the same small tax towards the freedom of communication which is so earnestly desired.

The late Prime Minister of the Commonwealth enthusiastically expressed some weeks ago every willingness to associate his country with a lowering of cable tariffs. This is distinct and clear, but we should like to see this opinion put into action.

To a country like Great Britain, which makes no terminal tax whatever, this kindly expression of goodwill is welcome. It is clear that while the Commonwealth charges an import and export tax of 5d. a word on all ordinary telegrams which reach or leave her shores, and while her rate of intercommunication within her coastal boundary is for some 3,000 or 4,000 miles the sum of 1d. per word, there is still something left to be done.

This cannot but be clear to those who have so strongly felt the necessity which they have acknowledged and which they are now urging.

To turn from the above to another subject: there was little said at the meeting to which we are now referring about the rate to India. The matter has been dealt with, but has now apparently come to a standstill. For years the inelastic Indian traffic, which stood at a rate of 4s. per word, and which, according to the prophets who deal with these matters and the mysterious joint-purse account, could not rise from the "slough of despond," waiting for better times, has at last found a little freedom owing to the efforts of men who have interested themselves in the subject. The figures show very clearly that an ample return of traffic has sprung up and has repaid the lowering of the price per word—so much so that it seems very clear that a still lower charge with deferred rates is a desirable sequence.

Owing to pressure of time at the meeting at the Mansion House there seemed to be no opportunity to elaborate the ideas which were clearly expressed on the map there shown, but the feeling of the meeting appeared to be very clearly in favour of State-owned cables as a method of at least controlling the companies, who until now have required discreet and wise rule.

The Late B. H. Thwaite: An Appeal.

In another column we gladly publish an appeal that is being made by a committee for funds to relieve the immediate necessities of the widow of the late B. H. Thwaite, and to provide for the bringing up of her two young children. We cannot but think that the country owes this to the late Mr. Thwaite, and when we realise the many hundred thousand horse-power capacity of blast-furnace gas engines already at work in Germany as the direct result of Thwaite's efforts, and also the immense capacity of the electric generators through which this gas power is made useful, we are compelled to the view that had a similar acceptance of his views obtained here that has been the case in Germany and Belgium, and even in America, the condition of the electrical industry would have been much more thriving to-day than we find it. Few grasp the immense outcome of Thwaite's discovery. It must not be that his widow and children shall be left in penury. Mr. Carnegie has signified his appreciation of the magnitude of Thwaite's work and the justice of this appeal by his conditional promise of £500.

Unemployment Problems.

In an article on "The Unemployed" in our issue of the 13th ult., we pointed out that a serious mistake would be made if public bodies, who were providing relief work for the unemployed, paid the full standard rate of wages for such work to any man until he had shown himself to be a capable workman. We regret, therefore, to see that at the special Conference on Unemployment promoted by the Right to Work National Council, which was held at the Guildhall recently, and at which delegates from 180 public bodies and organisations attended, a resolution was passed that employment by public authorities on relief work should be paid at Trade Union rates of wages, or, where no such rate existed, at a minimum of 30s. per week.

In all districts of London, and in the large provincial towns where relief works are likely to be started, a very large number of men in permanent employment cannot earn 30s. a week; and if public authorities should adopt this resolution, we should find numbers of men leaving their present employment in order to register themselves as unemployed, and so to qualify for the higher wage. In addition, it must be remembered that very many of the unemployed are unable to get work because, for one reason or another, they are not capable of doing work equal in quality or quantity to that done by the men who have been able to keep in employment; and, therefore, it is not fair to these latter to pay the standard rate of wages to a man on relief work until he has shown that he is worth as much as the average workman employed by contractors on similar work.

We also noticed that an addition was made to the resolu-

tion asking for the abolition from the labour market of the competition of men in the Army, Navy and Civil Service and police pensioners. If this means that the Right to Work National Council wishes to prevent men who are in receipt of a pension from increasing their incomes by becoming wage-earners, it is a peculiar interpretation of the "Right to Work;" and until the Council has been able to persuade the Government to increase all pensions to a minimum of 30s. a week, it is very unfair to propose that such pensioners should be debarred from all chance of obtaining a weekly income equal to that which is considered to be the minimum that can be offered to one of the unemployed.

The Revocation of Patents not Worked in England.

It is now a matter of common knowledge that under the Patent Act of 1907 the Comptroller has power (subject to appeal to the Courts) to revoke a patent on the ground that the patented article or process is manufactured or carried on exclusively or mainly outside the United Kingdom. The Comptroller has power to revoke unless the patentee, or other person having the interest of the patentee, can prove to his satisfaction that the patent is worked in the United Kingdom, or give satisfactory reasons why it is not so worked. The facts of the case may be very briefly explained by an example. A Belgian firm acquired two English patents of 1900 for the manufacture of a particular kind of tile. They set up a factory in their own country. It was conceded that they did not allow the process to be worked over here, although it was admitted that a sixth part of their total manufacture was imported into England. Various reasons for not working in the United Kingdom were put forward before the Comptroller. It was alleged that the supply was already equal to the demand; that the product could be more easily turned out in Belgium; that unless the applicant for revocation could show that manufacture of the tiles would be commenced in England, there was no ground to revoke. It was also asserted that as the party applying for revocation had no interest — he not intending to work himself — the Comptroller ought to refuse to revoke the patents. These arguments did not make much impression. In a long written judgment, which can be purchased at the Patent Office, the Comptroller explained his reasons for revoking these patents. He said: "Parliament decided to leave to the tribunal dealing with each case to determine, after hearing the facts and arguments, whether or not the patentee could give satisfactory reasons for his inaction. It is obvious that in determining this question, regard must be had not only to the interests of the patentee, but also to those of the public; and that the mere fact that it would be more profitable or convenient to a patentee to manufacture abroad than in this country cannot be regarded as a satisfactory reason for not taking the necessary steps for introducing the manufacture into this country. Otherwise, no advantage would be gained in any State of the Union (*i.e.*, in the States forming the International Union for the Protection of Industrial Property) by legislation under which patents can be revoked for non-working; because a patentee of his own accord, and without any legislative pressure, will naturally be disposed to manufacture where it is most profitable and convenient for him to do so." Dealing with the suggestion that the issue of advertisements for persons likely to take licences was sufficient evidence of an attempt or desire to work the patent in this country, he said: "It seems to me impossible to hold that a patentee can relieve himself from the duty of manufacturing in this country by the mere insertion at any time of a few advertisements, and the sending round to manufacturers of a few circulars to which no replies are received. The advertisements and offers in this case were, I may say, of the vaguest description; they gave no intimation of the terms on which the owners of the patents were prepared to treat, beyond the statement that such terms would be reasonable." The learned Comptroller's remarks with regard to the object of the legislation are also of interest. He said: "I have always regarded the object of the section as being to put a check on the practice, which was alleged to prevail very extensively, of taking out and maintaining patents in this country, not with any intention of working them here, but with the object of preventing the patented articles from being manufactured here, and from being imported by any other parties than the patentees. If, on the evidence which has been submitted in this case, the two patents in question may not be revoked, I find it very difficult to imagine any case in which a patent can be revoked under the section." Eventually he made an order revoking the two patents forthwith, and condemning the licensees in the sum of 45 guineas for costs.

LEGAL.

HIGH COURT OF JUSTICE.

Before Mr. Justice Warrington.

ALABASTER, GATEHOUSE & Co. *v.* EMMOTT & Co., LTD.

THIS was an action by Messrs. Alabaster, Gatehouse & Co., the proprietors of the ELECTRICAL REVIEW, for an injunction to prevent the defendants, the publishers of the *Mechanical World* and the *Electrical World and Record* from infringing the copyright of the plaintiffs, in articles and advertisements in the plaintiffs' paper, the ELECTRICAL REVIEW.

Mr. Percy F. Wheeler and Mr. W. Valentine Ball appeared for the plaintiffs, and Mr. George Cave, K.C., and Mr. H. A. Colefax for the defendants.

MR. WHEELER stated that the plaintiffs, who are the owners of the ELECTRICAL REVIEW, an old-established electrical paper, complained of the copying by the *Mechanical World* and the *Electrical World and Record* of articles which had appeared in the plaintiffs' paper, and of advertisements which had been taken wholesale out the plaintiffs' paper and put into the *Electrical World and Record*, the defendants were the publishers of the two last-named papers. Mr. Wheeler stated that he had agreed with the defendants' counsel, subject to his Lordship's sanction, to treat the motion as the trial of the action, and by consent to take a perpetual injunction in the terms of the notice of motion, the defendants to pay the costs.

MR. JUSTICE WARRINGTON: Very well.

MR. CAVE: My learned friend has mentioned one fact about a few advertisements which were taken without the knowledge of the editor, and with regard to the articles there is an answer, but as this is an agreed order I will not say anything.

MR. PERCY WHEELER: I do not suggest that the editor had any personal knowledge of the taking of the advertisements, but they were copied in such a wholesale way that it had to be put a stop to.

Overcrowding on the Metropolitan Railway.—Mr. Nield asks in the Parliamentary Papers whether the President of the Board of Trade is aware that there is overcrowding of passengers on the Metropolitan Railway between Baker Street and Harrow, owing to the reduction during the late morning and afternoon of the number of coaches, and that such overcrowding extends to carrying a number of persons on the guard's platform of the coaches of electric trains, preventing the ready ingress and egress of passengers; and whether he will cause an inquiry to be made and an intimation to be given to the company expressing the disapproval of the Board of Trade of this practice. Mr. Churchill replies that the railway company inform him that it is their practice to reduce the length of the trains on the section of line referred to from six to three cars between the hours of 10.15 a.m. and 5 p.m., when the traffic is comparatively light, and that as trains are run at regular intervals of five minutes, the accommodation afforded is found in ordinary circumstances to be quite sufficient. Trains of full capacity are, however, run throughout the day on Saturdays and on other occasions when the traffic is heavier than usual. As regards the conveyance of passengers on the carriage platforms, the company have a regulation forbidding this practice, and they assure him that the trains between Baker Street and Harrow will be kept under close observation, and that, if necessary, special steps will be taken to deal with any case of persistent disregard of the regulation referred to.

D

PRIVATE INSTALLATIONS.

[FROM OUR LEGAL CONTRIBUTOR.]

Many people who are accustomed to hear of electricity being supplied by the local authority or a company have a vague belief that it is illegal for a man to generate current and supply it to himself and to his neighbours.

This subject has often been touched upon in these columns, but in view of the fact that queries are frequently addressed to the editors with reference to private supply, it seems desirable to refer to it again.

It is fallacious to think that a man may not generate and supply electricity. The Electric Lighting Acts, which control and regulate the supply of electricity, are enabling only—that is to say, they confer certain rights and powers upon the holders of a provisional order; but they do not prohibit the private supply of electricity. They only control it in a limited degree.

The Electric Lighting Act, 1882, does not make any provision whatever for regulating the supply of electricity otherwise than under a provisional order or a special Act. Thus, after that Act was passed, whereas persons who supplied electricity under a provisional order were subject to rules made by the Board of Trade in carrying out the details of their undertaking, the owners of an installation who furnished their neighbours with a private supply were under no restriction whatever. For instance, by regulations made under the Act of 1882, the use of aerial lines was very much restricted; but these rules only applied to statutory undertakers.

In order to bring private supply companies under the jurisdiction of the Board of Trade, a special clause was inserted in the Act of 1888. By Sec. 4 of that Act it was provided that where in any case any electric line or other work may have been laid down or erected in, over, along, across, or under any street, for the purpose of supplying electricity, or may have been laid down or erected in any other position for such purpose in such a manner as not to be entirely enclosed within any building or buildings, or where any electric line or work so laid down or erected may be used for such purpose otherwise than under and subject to the provisions of a licence or provisional order, the Board of Trade may, by notice served upon the body owning or using the line, require that such line shall be continued and used only in accordance with conditions and rules which they may prescribe.

A proviso excepts from the operation of the section "every electric line or work laid down or erected by any body or person for the supply of electricity generated upon any premises occupied by such body or person to any other part of such premises." Thus a man who erects an installation for the supply of his own house or factory premises need pay no attention to the regulations. Any person failing to observe the regulations and orders of the Board of Trade is subject to penalties.

To avoid the necessity of drawing up sets of rules for every case, the Board of Trade have issued regulations drafted to meet the requirements of this section, the general effect of which is very similar to that of those which have to be observed by companies and local authorities which supply electricity under statutory powers. To deal with them at length would be beyond the scope of the present article. It may be pointed out, however, that Regulation 2 prohibits earth connection, except in the manner there provided. Regulation 4 limits the pressure between any two conductors or between any part of either conductor and the earth, to 3,000 volts. Regulation 14 substitutes 100,000 watts for the 300,000 in the ordinary regulations, as the limit which a high-pressure electric line may be used for transmitting. Regulation 17 provides precautions against injurious affection by induction; while Regulation 18 contains special provisions for the protection of the Postmaster-General.

Compliance with the Board of Trade regulations does not always completely protect a man who supplies electricity in the manner above described. He may have to observe certain by-laws issued by the local authority of the district in which his works are situated.

Thus he may find it necessary to lay his mains across a highway, and in seeking to do this he may come into conflict with the local authority who have control of the highway. This will probably be the case if the local authority are themselves supplying electricity in their district under provisional order, as they will naturally desire to restrain competition by every means in their power.

Dealing first with the question of overhead wires, it is clear law that unless the local authority own the soil of the highway they cannot entirely prevent the suspension of overhead wires if placed at such a height that they are completely out of the way of the traffic. This point was made quite clear some years ago in a case which was decided in the High Court. Those who wish to lay cables across the highway have only to make an arrangement with the landowners on either side by which they can obtain leave to erect posts for the suspension of the cables. In the rare case, however, of the local authority owning the soil of the road, it will be within their power to absolutely prevent any cables being so suspended, as the presence of such cables constitutes a technical trespass, the continuance of which may be restrained by injunction.

It should also be observed that in urban districts the local authority, by adopting Part II of the Public Health Acts Amendment Act, 1890 (53 and 54 Vict., c. 59), may acquire power to make by-laws for the prevention of danger or obstruction to the public from posts, wires, tubes or any other apparatus stretched or placed above, over, along or across any street (whether before or after the adoption of that part of the Act) for the purpose of any telegraph, telephone, lighting, railway signalling or other purpose. Again, in the case of London overhead wires can only be erected in accordance with by-laws made under the London Overhead Wires Act, 1891.

Coming now to the question of laying mains beneath the surface of the road, it may be stated, broadly, that no private person has any right to break up the surface of the road without the consent of the highway authority. Further, there is a section of the Public Health Act, 1875, which prohibits any man from placing a tunnel of any kind under a highway without consent. It would be competent for the highway authority to obtain an injunction to restrain the continuance of such a tunnel, and so to compel the person who made it to fill it up.

Strange to say, however, if a man is venturesome enough to take the law into his own hands, he may lay cables under the road without much fear of interruption, always assuming, of course, that the local authority do not own the soil. Two cases which have come before the Courts in recent years illustrate the truth of the above proposition. In the case of the Vestry of St. Mary, Battersea, *v.* County of London and Brush Provincial Electric Lighting Co. (1899, 1 Ch., 474), where an electric lighting company had illegally broken up the surface of a street within the district of a Vestry in the metropolis, and placed their pipes and wires at a depth of about 2 ft. below the surface, it was held that the Vestry were not, by virtue of Sec. 96 of the Public Act, the owners of the soil of the street at that depth, and that, although the company had acted illegally in breaking up the street, the Vestry could not maintain an action for a mandatory injunction to compel the company to remove their pipes and wires, there being no continuing trespass upon, or interference with, any right of the Vestry. With reference to this case, it made no difference that the trespassing company were statutory undertakers. A private person doing the same act would have been treated in the same way.

In the second case to which we wish to refer, a shipbuilding firm had works which were divided into two parts by a public highway. To supply electricity from one side to the other, they applied to the local authority for leave to suspend cables over the highway or to drive a tunnel beneath it. The local authority having refused, the firm drove a tunnel, which constituted an infringement of the Public Health Acts. They laid their cables at the bottom of the tunnel. The local authority applied for, and obtained, a mandatory injunction to compel the firm to fill up the tunnel, but the Court refused to compel them to remove the cables. In this way they gained their object by taking the law into their own hands.

The question sometimes arises whether supply undertakers are obliged to give a supply of electricity in the case of consumers demanding it, when the object for which they intend

to use such supply is to provide a stand-by source of lighting in case their own plant should break down. There is nothing in the existing Electric Lighting Acts to prevent a consumer adopting the course suggested. He may be required to give particulars showing the number of lamps or the amount of power which he requires, but there is nothing in their statutory powers to enable an electrical company to compel the consumer to take a continuous supply. It is interesting to note, however, that a Bill which is now before Parliament contains the following clause :—"Notwithstanding anything in the Electric Lighting Acts or in any Act of Parliament or provisional order authorising an undertaking, a person shall not be entitled to demand from undertakers authorised to supply electricity in any area a supply of electricity for any premises having a separate supply, unless he has agreed with the undertakers to pay to them such minimum annual sum as will give them a reasonable return on the capital expenditure, and will cover other standing charges incurred by them in order to meet the possible maximum demand for these premises. The sum to be so paid shall be determined, in default of agreement, by arbitration under the Electric Lighting Act, 1882."

In conclusion, we may refer to one question which has frequently been addressed in one form or another to "Our Legal Query." column in the REVIEW. Suppose a man were to take a supply from the station at power rates. By thus doing he would get the current at a less cost than he would have to pay if it were used for lighting purposes. He could well afford to have a motor-generator and supply himself and his neighbours with electric light. Would this be legal? The view has always been expressed that any such use of a motor-generator is illegal. For a man to take a supply of energy at motor rates and use it for lighting purposes, is little short of a fraud on the supply company.

THE TEACHING OF MATHEMATICS TO STUDENTS OF ENGINEERING.

By "X."

THE question as to how best to teach mathematics to engineering students is at present engaging the attention of many people in America, and the discussion has brought out nearly as many views on the subject as there are students to teach. If it shows one thing clearly, it is that there is something radically wrong with our present system, for we learn that where one man recommends the study of descriptive geometry at the commencement of the course, another recommends it at the end, that a preliminary training in pure science is held proper by some, and rejected by others, that anything higher than the calculus is nonsensical, that to stop at the calculus is the height of folly, that formulæ should be passed over, that formulæ are right in the right place, and so on. Nobody is agreed as to anything, and the matter threatens to become the best topic of discussion laid by the heels for many a long day.

We need only concern ourselves with America in the guise of amused lookers-on, for our educational methods taken as a whole are undoubtedly the better. But in this one subject of engineering mathematics, we are as backward as any, and it is the object of the present article to present in as clear a form as possible the methods that appear to the writer best calculated to effect the desired result. It is a matter for wonder that in a subject of this type, the discussion should have been carried on so very unmathematically; that there should be no statement, construction, or subsequent proof set forth in any logical way; for, as a matter of fact, anyone who can discern a statement, construction *or* proof in all the plethora of words that have been called up, will be a most discerning individual indeed.

Mathematics for students of engineering. What students? Are we concerned with students taking a three or four-year course on the engineering side of a university, a university college or similar institution; with students attending trade classes at a technical school; or with mechanics receiving no instruction, but who nevertheless may be looked upon as students of engineering? It is obvious that the man attending in the first of these is likely to want more mathematics than he of the second or third, for it is becoming increasingly apparent from the writings of many that mathematics applied to engineering has a direct monetary value, and the man who spends time and energy and much coin on a university course will require a corresponding quantity of mathematics in payment thereof.

It is assumed that the university students will do most of the subtle work of engineering of the future, by virtue of the pains spent on their training. What mathematics will they need? A consideration of this requires a consideration of all the special branches of engineering, which would certainly be beyond the scope of this article, but it may be said that nearly every branch requires a somewhat different mathematical treatment. For instance, railway engineering requires less knowledge of the calculus than electrical or bridge engineering. It, therefore, seems best that, in view of the specialisation obtaining in all departments of practical work, mathematical courses should be specialised in colleges to adapt them to each branch of engineering.

As students who attend trade schools can never hope to do the fine work of the profession, it is necessary to teach them mathematics suitable only to the work they will be called upon to do. They will become mechanics, foremen, under-managers, &c., and, of course, will not touch the higher branches of design except in very special cases. Their mathematics should end on the near side of the calculus and no specialisation is necessary. Mechanics, &c., who do not attend classes require only common-sense rule-of-thumb mathematics that they pick up for themselves. This is practical mathematics in the true sense.

There is not so much divergence of opinion as to what mathematics is necessary for each type of student, as to how this mathematics should be taught. That is *the* question. *How* are we to teach, *who* are to teach, *when* and *where* is the teaching to be done? Are the students to be caught young, or to be taken in hand when they reach the wisdom of maturity? Only a consideration of the results obtained is of the slightest use in judging of this and kindred questions, and no amount of hypothesis will advance us one iota.

The question as to whether pure mathematics or practical mathematics is best, or what combination of them is best, must first be settled. Many faddists in this country are all for teaching by the practical method; they have issued numerous publications on such things, as the *calculus for engineers*, the mere perusal of which is apt to give one's spirit a chill; they are usually noisy in their declarations of how and what to teach, on logical conclusions, or facility of acquirement by their methods, and so on. But it is really absurd to suppose that mathematics can be taught in this way, for that *essence* of a mathematical training is absent, that elementary consecutive proof upon proof so necessary to our forefathers, and necessary still for all who would *think* mathematically.

Mathematics for engineers should, therefore, always be commenced by a good, all-round study of the elements of Euclid and Algebra. There is no necessity to have examples from practice inserted in the text-books of this period; much better is it to sail along plainly in what many call the "uninteresting" sea of pure reasoning. For if the poor student cannot assimilate this elementary portion, or gets weary and dog-tired over it, what chance has he of grasping mathematics firmly by the hand when he gets further on? What chance has he of *thinking* mathematically, no matter in what new-fangled fashion the subject is falsely presented to him? After this preliminary training he goes to his college, and should still keep at his practical mathematics in the old way, but at the same time he should be in classes where the useful aspect of the subject is taught. There is no better place than a good steam or mechanics laboratory for this, presided over by a man who knows just where the physical interpretation of an equation comes in. The student by this time knows the A B C of mathematical manipulation, and consequently he has no trouble with technique, and he is now in a position to fix physical meanings to his mathematical symbols; as day-by-day he has practice in applying his symbols and formulæ—he begins to absorb the engineering meaning of mathematics.

It is really not so difficult as we are given to suppose, for the only requisites to the desired result are the use of the proper system and sufficient time to absorb it. Unfortunately the question of time is a very serious matter, for there can be no doubt that too much is attempted in our three or four-year engineering courses.

It is a well-known fact that the mathematics required, even by those who undertake the most advanced type of engineering work, is not in reality very extensive, and all the gush that is hurled forth into the pages of the engineering magazines is mostly by men who are not strong on the practical side, yet who are, on the contrary, good theorists of engineering. It is certainly not the quantity of mathematics that counts; it is very often the quantity that fails. What does really matter is that *useful* mathematics should not only be learned, but should be *absorbed*, and this absorbing process can only be brought about by a good general education of pure principles in the first place, and much and long-continued quantitative experimental work in the second.

Students who attend evening classes, or, perhaps, a few special day classes in technical schools, are mostly engineering apprentices, and as such cannot, of course, afford the time and money necessary for University courses. Hence they undergo severe limitation, and can scarcely hope, other things being equal, to take the positions in the profession that should naturally fall to the lot of their more fortunate brethren. Their training in mathematical engineering should, however, be made as thorough as is consistent with these limitations. Every technical school that is worthy of the name, will see to it that not onlymust its students have a certain amount of mathematical education before entering its classes, but it will also ensure that the mathematics taught within its walls is of the most useful standard that experience can suggest.

The trade students are chiefly remarkable for their number. Many of them, too, are young men exceedingly anxious to get on and rise above the limitations nature bestowed upon them at birth.

At present there are numerous faults to be found with the methods of instruction in these schools as applied to mathematics, the chief being as follows:—(*a*) Students are not sufficiently well-grounded when they enter the classes; (*b*) the mathematics is not taught by the right men; (*c*) the most useful type of mathematics is not taught. With regard to (*a*), the remedy is to impose an entrance examination just sufficiently difficult to ensure that no student who is unable to do a little algebra and geometry shall enter. Schools may be established for such backward people elsewhere than in the technical school itself (preferably in the elementary school buildings), where they can receive a preliminary training sufficient to enable them to benefit by the more advanced work, in a succeeding session. But this preliminary training should be more on the lines of pure mathematics than is usually the case at present.

The men who teach the mathematical classes in these trade schools are very often by temperament, and more often by training, unsuited for this type of work. They may be roughly divided into two classes: (1) The professional teacher (either of the elementary day-school, or of a secondary school); (2) the practical man.

The first has not enough of practice, and the second insufficient theory. How can a man whose daily work consists in teaching school children, come down to the technical school of an evening and pretend to teach the right kind of mathematics, to the budding engineers he will have under his control? What chance has such a man of understanding and absorbing mathematical formulæ, giving intuitively concrete meanings to his symbols and in general *thinking* mathematically, when he knows nothing of engineering processes, and of engineering laws and limitations? Yet all he has to do to be qualified to teach practical mathematics is to pass the second stage of the Board of Education's examinations on the subject. The practical men, on the other hand, usually come from the drawing office or occasionally from other departments of engineering works, and the trouble here is that they usually know very little about mathematics at all. They rely for the most part on formulæ cribbed from pocket books, and have no more knowledge of the inner engineering meaning of the symbols than the man in the moon. The remedy for this sort of thing is simple. Each technical school should have one or two men on its staff to take the work of the engineering department, men who are paid a fixed annual salary to undertake this duty, and who accordingly spend the whole of their time at it. They should be graduates of engineering who have had considerable practical experience, and all the mathematical teaching in the school should be strictly under their supervision. How are we to obtain such men? Not, let it be said, by offering a salary that a second-rate mechanic would not accept, but by offering an amount consistent with the expensive training they had to undergo to fit them for the work.

The principals of technical schools should preferably be men who have graduated in engineering, for not only are they then *au fait* with the chief work taken in the school, but it is a recognised fact that a thorough engineering training is the best means of obtaining the kind of organising ability requisite for conducting the affairs of such schools.

The writer has in his mind's eye instances of principals of these institutes who have graduated out of secondary schools or out of the pure science side of a university, or even out of the art side, and whose best acquaintance with practical work lies in the construction of a dog kennel or an ornamental picture frame. They have to call in outside help if the front door knocker goes wrong. This is not as it should be, and it will have to be altered before anything like efficiency is obtained. Only the men who have had considerable practical experience should be allowed to direct the destinies of technical schools.

BENJAMIN HOWARTH THWAITE.

To Benjamin Howarth Thwaite, who died in the spring of this year, belongs unquestionably the credit of perceiving the enormous value that was going to waste in the shape of the gaseous output of the blast furnace; of proving his contention by an actual test, and of rousing the ironmaking world to a sense of the significance of his findings. Thwaite was not a business man, or he would have secured for himself something out of the great fuel saving that his discovery has made for the world. His general habit of thought was speculative, but in practical work he was never unsound, though, perhaps, too optimistic in that his vision was apt to overtop the practical obstacles in the path, and he saw, perhaps, too clearly, the ultimate results. It was so with his ideas of blast furnace gas. What he saw in 1894, was a vision of England dotted over with large gas engines to use the millions of potential horse-power of gas that was flowing to waste. He lived to see a realisation of this vision, but it was in Germany. But for him there would have been no large gas engines to-day. The large engine of necessity had to be built to consume the huge volumes of available gas. And so it is that Germany has to-day over 30 builders of large gas engines, and that since 1902, one firm alone has built, or is building, 247 engines aggregating 308,000 H.P., in itself a sufficient reason for the world's gratitude. Misfortune often attends on genius, and Thwaite had genius. To Mr. James Riley he owed the opportunity of proving his case. To Mr. Frank Gardner he owed the financial support which endured until the collapse of South African mining which followed the outbreak of war. Thus when on the eve of success came the misfortune which he was not able to overcome. Thwaite was full of belief in himself, but his self-esteem never led him into any personal or domestic extravagance, and he lived quietly in a country village. All he had or could make, he spent on his work in pioneering blast furnace gas utilisation in the face of obstacles that would have daunted stronger men. But the effort proved too much for his physical strength, never great, and he died worn out by the unequal struggle and the adverse fate which, in the shape of mortal sickness, followed him even in his home. He deserved better of the world than to have died unable to provide for his invalid wife (who, it ought to be mentioned, has already undergone one terrible ordeal in the shape of an

operation for malignant growth, and is at present suffering from what may yet prove to be a recurrence of the same complaint), and for his young children, and we are glad to draw attention to the appeal that is being made on their behalf by a committee that has been formed to collect a sufficiency to add to the nucleus of the fund promised conditionally by Dr. Andrew Carnegie in recognition of the debt owed to Thwaite by the iron and steel trades for the great fuel economies he has effected; by the mechanical engineers, for the huge business in gas engines that has sprung from his efforts; and by electrical engineers, by whose appliances so much blast furnace-generated power has been, and will be, transmitted. A development in Great Britain similar to that which has already taken place in Germany would keep our engineers and our large electrical works well occupied. We earnestly appeal to all to help the fund that is being raised.

Subscriptions may be sent to the Honorary Treasurer, whose name is given below.

We may add that it is hoped to collect a sufficient fund for Mrs. Thwaite's urgent and immediate needs, and for the bringing up of the two young children—a son of 8 years and a daughter of 15. The committee consists of the following gentlemen :—

Sir A. B. W. Kennedy, F.R.S., Past President Inst.C.E., &c.
Sir W. H. Preece, K.C.B., F.R.S., Past President Inst.C.E., &c.
W. M. Mordey, Esq., M.Inst.C.E., President Inst.E.E.
R. K. Gray, Esq., M.Inst.C.E., Past President Inst.E.E.
J. O. Arnold, Esq., Professor of Metallurgy, Sheffield University.
H. Alabaster, Esq. (Electrical Review, London).
Harold Jeans, Esq. (*Iron and Coal Trades Review*).
T. E. Gatehouse, Esq., F.R.S.E., A.M.Inst.C.E., M.Inst.E.E., M.Inst.M.E. (Electrical Review, London).
W. H. Booth, M.Am.Soc.C.E., *Hon. Sec.*, 2, Queen Anne's Gate, S.W.
A. M. Sillar, Esq., M.Inst.C.E., M.Inst.M.E., M.Inst.E.E., *Hon. Treasurer.*

THE PHYSICAL SOCIETY'S EXHIBITION.

(*Continued from page* 1045.)

Messrs. Elliott Bros.

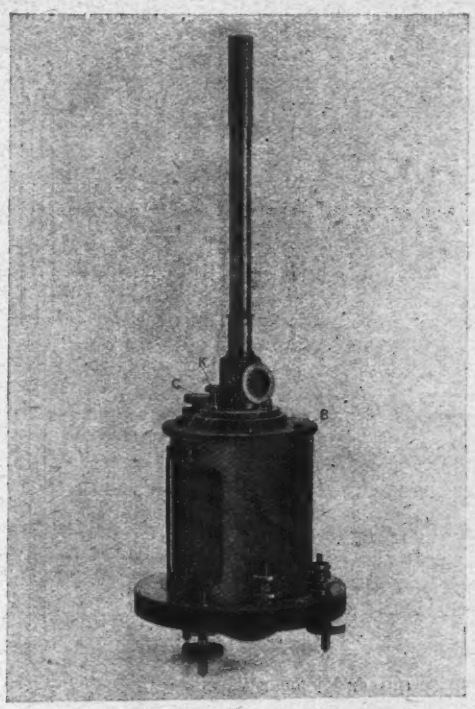
This firm had a varied show of galvanometers, testing sets, instruments, &c., including many other arts besides electrical. The "Century" D'Arsonval galvanometer is a much-improved form (see

Type "P.P." Portable Standard Wattmeter.

fig.), being designed so as to secure the greatest possible sensibility, combined with ease of access to all of its parts. The "Century" testing sets are familiar to all electrical men. A leakage indicator for use on D.C. circuits was shown; it consists of a moving-coil milliammeter with centre zero, provided with two push-buttons. On pressing these successively, and comparing the deflections with a table given on the instrument, the insulation resistance of each main can be determined.

A portable standard wattmeter for A.C. circuits, type "P.P.," is illustrated; this instrument is of the dynamometer type, but has only two coils, of which the outer is the moving coil, and the inner is wound in the shape of a ball. It is claimed that this construction gives increased efficiency, and enables stronger control to be employed together with a coil of relatively less weight and inertia, without increased inductance.

The Harrison universal photometer was shown, with an improved attachment consisting of a horizontal white screen on the top of the instrument, by means of which the total horizontal illumination can be determined. Small micrometer gauges reading to

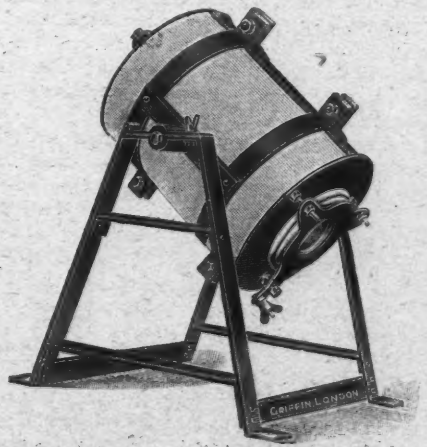


"Century" D'Arsonval Galvanometer.]

0·001 in. are now being made by the company, and several samples were exhibited. We should mention also Baillie's testing apparatus for liquid fuels, in which the volatility of the fuel is measured by ascertaining the amount of air required to evaporate a given quantity of the fuel, and comparing this with the result obtained from a standard fuel—namely, heptane. This test applies mainly to petrol, and does not indicate the calorific value of the fuel.

Messrs. J. J. Griffin & Sons, Ltd.

Messrs. Griffin showed several Heraeus electric furnaces, of which one, a tilting furnace, is illustrated herewith. The tubes are of highly refractory porcelain, surrounded by very thin platinum ribbon—not wire. It appears that with this construction only one-sixth of the platinum otherwise required is necessary. A temperature of 1,400° C. is easily reached; beyond

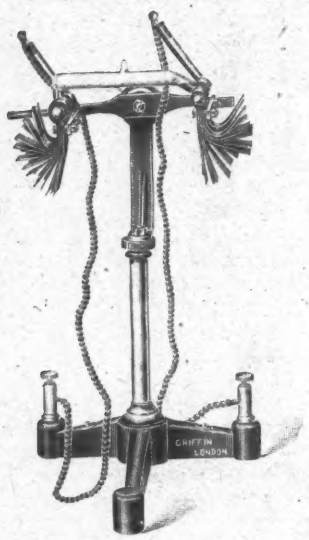


Tilting Electric Furnace.

this, the porcelain begins to become a conductor, and suffers from electrolysis. Platinum resistance thermometers, insulated with quartz and mounted in quartz tubes, were exhibited; these have the

advantage that the quartz is not affected by sudden and wide changes of temperature, and the resistance wire, whilst perfectly protected from the injurious effects of vapours and gases, responds quickly to change of temperature, being closely opposed to the quartz envelope, as shown below.

A quartz mercury amalgam lamp intended for the production of ultra-violet rays was shown. This is an improved form of the Heraeus lamp, and is illustrated herewith. The bulbs are so proportioned, that as nearly as possible the heat radiated may be equal to the heat generated at each pole, a condition that must be fulfilled to give continuous burning; and to ensure this result the neck of the cathode bulb is contracted in such a way that any error in the heat balance is automatically corrected. The bulbs are surrounded



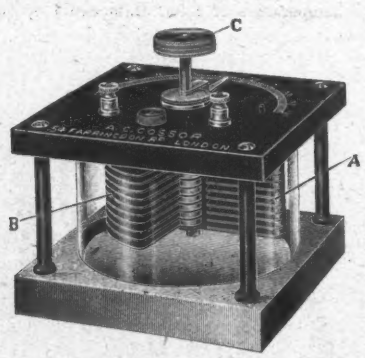
Quartz Mercury Vapour Lamp.

Platinum Thermometer.

by metal bands carrying radiators. On a 220-volt circuit, with a regulating resistance of 60 ohms in circuit, the lamp can be made to burn continuously with any P.D. between its terminals from 25 to 175 volts; at the latter pressure, with 4 amperes, the mean spherical candle-power obtained is about 2,866 C.P., or at the rate of 0·244 watt per candle. Lamps are also made for 110 volts. The amalgam consists of mercury, lead, bismuth, and traces of zinc and cadmium.

Messrs. A. C. Cossor, Ltd.

An interesting feature of this exhibit was Walter's tantalum wave detector; this consists of nothing more complicated than a little bulb, like a small glow lamp, containing a tantalum filament dipping into a small quantity of mercury. Another item was an improved form of variable condenser, which we illustrate; this



Variable Condenser.

consists of a set of fixed vanes A alternating with a set of movable vanes B, forming the two poles. The movable set is attached to a milled head and pointer C, the latter moving over a scale. The condenser may be filled with air or oil as dielectric, and the moving system is carried on ball bearings, to enable the finest adjustments of capacity to be made.

Sir Oliver Lodge's valve tubes for high-pressure currents, with other X-ray apparatus, and the Rose vacuum pump, in which the piston is actuated by an electromagnet from the outside of the cylinder, thus obviating leakage of air, were also exhibited.

Messrs. Nalder Bros. & Thompson, Ltd.

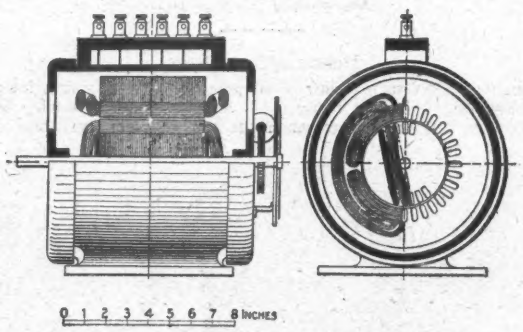
This firm's exhibit included the well-known "Ohmer," fitted with a vibrating reed to indicate that the correct speed and pressure of the generator has been attained; portable testing sets, including a convenient combined set of ampere and voltmeters and shunts in a case; an indicating wattmeter, with the moving coil of the

N.C.S. Wattmeter.

Ayrton & Mather type, designed to have extremely strong working forces; and the telethermometer, a moving-coil ohmmeter on the bridge principle, with which the temperature of any place is electrically indicated at a distance. The last-named instrument is rapid and sensitive, and is far superior to the usual means adopted for measuring the temperature, for instance, of cold stores, &c. The movement of the wattmeter here illustrated was designed by Dr. Drysdale, and consists of a coil moving in the field of a powerful electromagnet with a soft-iron core; this instrument is not the original Drysdale wattmeter, but a greatly improved design, and besides being suitable for both D.C. and A.C., it is accurate on low power-factors, independent of frequency and wave form, and dead-beat.

Messrs. Snell & Tinsley.

A number of very interesting apparatus were shown at this stand. First was the Drysdale standard wattmeter; this gives accurate results, even on the lowest available power factors, and the double wattmeter, being fitted with two complete



Drysdale Phase-Shifting Transformer.

sets of coils, is capable of measuring accurately the power in single A.C., polyphase, or D.C. circuits. The instrument exhibited carries 50 amperes per phase, and reads from 0·01 watt per div. at the lowest limit to 250 watts at the highest. A resistance box with minimum capacity and inductance, specially intended for wattmeter pressure circuits, the coils being wound on mica plates in single layers, and capable of being immersed in oil, showed novelty in design and excellent results, and a phase-shifting transformer designed by Dr. Drysdale, for testing wattmeters, &c., at varying power factors, was exhibited and is here illustrated.

A siphon recorder designed by Mr. R. H. Edgar was shown, in which the suspension piece is so constructed that it stands without support when removed from the body of the instrument; when it is necessary to remove the suspension piece, it is simply slid off the guide rods, which action automatically disconnects the coil, and another suspension which has been kept ready in adjustment for the purpose, can immediately be put in circuit in the same way.

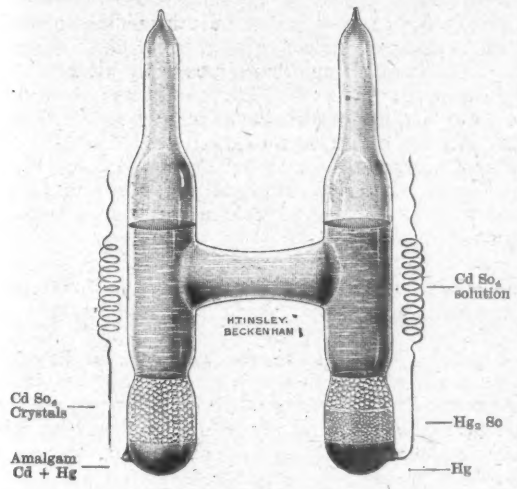
A double-current key for submarine-cable working was shown, in which the levers are L shaped, and the contacts horizontal, enclosed in a glass case as a protection against dust. The contacts can be seen and got at easily, whereas in existing types the contacts being vertical and under a strap are not readily accessible.

The Tinsley direct-reading potentiometer is designed to work on any accumulator between 1·8 and 2·2 volts, and between these voltages adjustment can be made on the instrument itself without any supplementary rheostats, two of these, a coarse and a fine one, forming a portion of the potentiometer itself. The fine adjustment rheostat is fitted with a micrometer screw, which enables an adjustment to 0·0001 volt to be easily obtained.

The main balancing coils consist of 17 manganin sections in series with a platinum-silver slide wire divided into 110 equal parts, and an extra set of coils on the Thomson-Varley vernier principle, thus giving a useful range from 0·00001 volt up to 1·8 volts; the instrument is capable of being read to 0·00001 volt over its complete range, forming a most useful piece of apparatus for measuring pressures of all descriptions.

Being in series with the main coils, instead of a vernier to the set of vernier coils, the slide wire can be made twice as thick as in the latter case, with one-fourth the resistance, and is independent of the vernier contacts.

Sliding switch condensers, and a new Morse key were shown, and, lastly, standard cadmium cells—in the manufacture of which the



Tinsley Cadmium Cell.

firm are specialists—accurate to within one part in 100,000, and made in accordance with the National Physical Laboratory specification, were exhibited. These cells, which have an E.M.F. of 1·0195 volts at 15° C., have a temperature coefficient of only ·00004 volt per degree, and are far superior in constancy and convenience to the old Clark cell, with its awkward voltage, and its enormously greater coefficient.

The Cambridge Scientific Instrument Co., Ltd.

This company showed in operation the Abraham Rheograph, of which we gave a full description recently (see Electrical Review, December 4th, page 983) as made by Messrs. Carpentier. The Cambridge extensometer, a controlled slide for moving photographic plates, the Méker patent burners, the Féry radiation pyrometer, and the Joly steam calorimeter and meldometer were amongst other items. In the Callendar & Barnes continuous-flow calorimeter, a current of water passes through a glass tube surrounded with a manganin wire helix, which is heated by an electric current; the temperatures of the water at inlet and outlet are measured when steady, and in conjunction with the rate of flow of the water, give data for determining the heat equivalent of the electric power expended in the helix.

The Joly meldometer is used for determining the melting points of very small specimens, which are placed on a strip of platinum heated by electricity; the extension of the platinum strip indicates the temperature at the moment when the specimen melts.

A hermetically sealed manganin wire standard resistance, which is free from the influence of variations in the humidity of the atmosphere, and a Normal Weston cadmium cell of H pattern, as recommended recently by the International Conference on Electrical Units and Standards, were also exhibited.

Mr. Hans Knudsen.

A demonstration of the wireless transmission of photographs was given during the evening by Mr. Knudsen. In this system a negative is prepared with the surface contour varying as the density of the deposit, and is traversed by a style, which follows the contour and sends impulses to the line, which actuate a similar style marking a surface coated with lamp-black.

Messrs. A. Gallenkamp & Co., Ltd.

Amid a number of non-electrical apparatus, this firm showed an electric tube furnace for temperatures up to 1,000° C.; the winding is of nickel, which melts at 1,430° C., and is, therefore, as good as platinum within the range mentioned, while it is enormously cheaper both in first cost and in repair. The tube on which the wire is wound is of silica (quartz), which does not crack when subjected to variations of temperature, and is surrounded by a wider tube, the intervening space being filled with finely powdered quartz. The outer tube is lagged with magnesia, in two sections, encased in a thin hinged iron cover. The tube attains a temperature of 1,000° C. in 20 minutes, with 650 watts, and can be kept steady at 910° C. with 400 watts, so that the cost of energy is trifling.

Messrs. Gambrell Bros.

This firm had a variety of resistance boxes, galvanometers, &c., on view, as well as the Davies patent long range ampere or voltmeters, and Mr. J. P. Yorke's apparatus for the demonstration of electrical and other phenomena with the projection lantern. Universal shunts suitable for all climates, dial resistance boxes, &c., and bridges were also shown, including a metre bridge with an improved form of sliding contact key.

Messrs. Marconi's Wireless Telegraph Co., Ltd.

This company showed a new instrument for tuning wireless telegraph receivers, by means of which great immunity from interference is obtained. It may be used for measuring the length of the waves transmitted or received at a station, or the distance between stations, and is suitable for all wave-lengths between 300 and 800 ft.

The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

This firm exhibited Mr. Raymond-Barker's two-tone transmitter, suitable for use with acoustic, visual or recording receivers. The transmitter produces two musical notes, corresponding to the dot and dash of the Morse code, but of equal time value. By means of this transmitter, in conjunction with a Gott fault-searcher coil, inductive signalling has been carried on over a distance of 60 miles between a cable ship and a land station, during the making of the final joint and splice of a cable repair. Other exhibits were the Appleyard conductometer and conductivity bridge, for determining the percentage conductivity of wires and rods, which have already been fully described in the Electrical Review (June 5th, 1908); in both instruments the main feature is the method of compensating for small differences of diameter or of mass between successive specimens of the same nominal dimensions or weight. The Silvertown testing sets were also shown.

A GERMAN ANSWER TO MR. MORDEY'S PRESIDENTIAL ADDRESS.

The *Elektrotechnische Zeitschrift* contains in a recent issue an article, headed: "Electricity Supply in England and Germany," and signed by Mr. K. Perlewitz, as follows:—

In his inaugural address on November 19th, 1908, Mr. W. M. Mordey, president of the Institution of Electrical Engineers, gave a survey of the English electrical industry in comparison with that of other countries, the use of the electric current for lighting, power and traction in England and Germany respectively being in the main dwelt upon. The present writer finds the reason for the figures being so much in favour of England in the fact that Mr. Mordey has not allowed to the proper extent for the peculiar conditions prevailing in the German electricity supply business.

Mr. Mordey only considered such undertakings as in England are called "public supply stations," and in the case of Germany the list of these, on which he based his calculations, was incomplete. On the other hand, he neglected the small private central stations, especially numerous in Germany, which often sell electricity as a side line. That this class of supply has scarcely any importance in England is connected with the difficulties of obtaining provisional orders in that country.

But the statistics for Germany are affected in a still higher degree by the numerous and isolated plants (*e.g.*, in factories, stores, restaurants, block stations, &c.), which generate current, as a rule, only for their own use, or supply customers in their near neighbourhood and where there is no necessity for laying down mains in the public streets. Again, this class of supply is much more numerous in Germany than in England. In short, if one intends comparing the supply of current in both countries on a just basis, one must not single out one particular class of supply stations, viz., what in England is called a "public supply station," but has to take into consideration all generating stations of electric current.

For the start of his investigation, the writer chooses Mr. Mordey's Table D which is said to represent the total power of "all" English and German electric supply stations.

	kw.	Inhabitants, mill.	Watts per inhabitant.
England ...	983,181	45	21·8
Germany ...	612,652	63	9·7

Mr. Mordey informed the writer that the above figures for Germany were obtained from the outputs of the stations as stated in the statistics for 1907 of the Vereinigung der Elektrizitätswerke, whereas the respective figures for England extend to March, 1908. The figures given represent only the output of the generators (without converters), exclusive of batteries.

First of all it should be mentioned that the statistics named, viz., of the Vereinigung der Elektrizitätswerke are very incomplete respecting the number of stations. They only give 241, as against 1,530 central stations for lighting and power supply, mentioned in the general statistics of the *E.T.Z.* over the same period (*E.T.Z.*,

November 11th, 1908). All of these stations serve "public" purposes, *i.e.*, their mains are laid down in public streets, they supply whole towns or parts of such, and they are consequently to be regarded as "public supply stations." The objection raised by Mr. Mordey to the writer, to the effect that many of these plants sell current only as a side line, while being in the first instance factories, collieries, breweries, mills, &c., is not valid, inasmuch as this kind of electric supply is characteristic for German conditions.

Such stations as supply current solely for tramways or railways are not contained in the figure 1,530. Neither is the output included in the sum total, of batteries which serve for traction purposes in the above 1,530 stations.

The total power of the 1,530 stations mentioned was:—On April 1st, 1907, 674,595 KW. in machines (without converters) and 128,090 KW. in batteries.

From curves representing the development of the German supply stations, the writer has obtained the corresponding figures for April 1st, 1908, viz.:—784,500 KW. in machines (without converters) and 150,000 KW. in batteries.

Further, it has been ascertained that for traction on April 1st, 1908, an additional 44,600 KW. in machines (without converters) and 25,000 KW. in batteries were employed, the latter amounts not being contained in the above figures. This gives a total power of all "public" supply stations on April 1st, 1908, of 829,100 KW. in machines (without converters), and 175,000 KW. in batteries, or, added together, 1,004,100 KW.

Now Mr. Dettmar has ascertained (*E.T.Z.*, 1908, page 1188) that the total output of "isolated plants" (machines and batteries) will on April 1st, 1909, amount to 6,000,000 KW. Supposing a similar development as with electric supply stations one finds, calculating backwards to April 1st, 1908, 5,450,000 KW. in machines and batteries, and the sum total of all the generators and batteries for electric supply in Germany on April 1st, 1908, is reached as amounting to, roughly, 6,450,000 KW.

This amount works out to about 100 watts per inhabitant, if we take, as Mr. Mordey did, 63,000,000 inhabitants.

It is only this figure which can be regarded as the standard of the electric supply in Germany, and the due verification of the figure 21·8 watts per inhabitant for England is to be left to Mr. Mordey. Taking the basis recommended by the writer—who holds that it is a just one—for comparison, a ratio is likely to result which is as unfavourable for England as the figure given by Mr. Mordey has been favourable. Besides, the "utilisation of the machine power," *i.e.*, the kilowatt-hours per annum per inhabitant, would have to be compared.

It follows that not only the power per inhabitant of the whole country is to be rectified, but also the power, amount of energy and revenue, &c., per inhabitant for the different towns ought to be worked out afresh from the new point of view.

It will be seen that so far as the aggregate is concerned, Mr. Perlewitz reverses the situation altogether; but it must be borne in mind that he has imported into the matter a class of installation not touched by Mr. Mordey, and though the number of such in this country is not so great as in Germany, they would form a very considerable item. Further, the author includes accumulators as generating plant. It is not usual to do so in this country, though in considering the total output capacity of a station, we think it is a not unreasonable practice—but Mr. Mordey did not adopt this view.

It is questionable whether private installations which supply energy to surrounding premises can fairly be classed with public supply systems carrying out statutory powers, and it will be noticed that Mr. Perlewitz's figures for the 1,530 public stations have an output (estimated to April 1st, 1908) only some 170,000 KW. in excess of Mr. Mordey's figures for 241 stations; that is, the average output for the additional stations is only about 130 KW. each, and the total is still far below that of the British stations.

Mr. Perlewitz does not say a word about the comparison of output, prices, and costs of electrical energy provided by the public supply systems here and in Germany. He apparently accepts without question the general conclusion that the public is very much better supplied here than in Germany—the real point of the address.

The fact that the total KW. of private plants in Germany is very large, is, no doubt, a natural result of the inadequate public supply to which Mr. Mordey has drawn attention.

Social Function.—The Aberdare Corporation Electricity Department held an "At Home" recently, about 100 employés and friends being present. Mr. Bell briefly addressed the gathering.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Cheap House Wiring.

Referring to "E.C.S.'s" letter under the above heading in your last issue, I should like to express the opinion that a man who allows a £10 note to stand between him and the electric light is a ——, well—to put it mildly—an unmitigated, hopeless, benighted, stodgy, ignoramus. Why, the man could have recouped himself certainly within a couple of years or less, on the very lowest estimate; as might be proved to him, had he enlightenment enough to understand what increase of personal energy, lessened depreciation, saving of time and temper, better light, low lighting bill, and safety mean. You know the old, old story Mr. Editors, which some people take so long in grasping, or never will grasp.

A man like that deserves to be made to sit on the top of a step-ladder for half-an-hour per evening in his own gas-lit apartment; half-an-hour would be quite enough; and ventilation—by the way—would make very little difference.

I speak feelingly and with full knowledge, for having just left a house which I wired and fitted at my own expense (about £40—an outlay which I never once regretted), I am now condemned to spend my evenings and early mornings under gas, being just 150 yards or so too far away for the electric supply people to connect me up.

We (*i.e.*, the head of the house, myself, dog, baby and help) have a choice selection of gas fittings—ancient and modern, with flat-flame and upright and inverted incandescent burners. The latter cast their mantles in a positively indecent manner on the slightest provocation—*e.g.*, when someone is feeling for matches and knocking the furniture and themselves about in the room overhead. I am becoming quite expert in the manner of burners and mantles—worse luck, but I begrudge every shilling required to improve the fittings and renew the mantles. The avoidance of the mantle trouble alone is worth £5 a year, in my humble opinion. As regards the fittings, they are a collection of eye-sores and spoil the look of everything else.

It is a good many years since I had to live under gas, and I do not relish it. Oil lamps would be healthier! but these are out of the question in a *ménage* which includes a robust baby and a robustier dog. In my study I have an upright indecent—incandescent burner, I mean—and I have to alternate between "burnt air" and draughts from an open window. There seems to be no happy medium, try how one will. What it costs me in wasted time, unholy feelings at being poisoned, and general perturbation of mind and body, would pay for a silver-plated conduit installation in three months. Why didn't I get nearer the mains? Because I was seduced by the impression that the mains were coming to me.

Elsewhere, I am subjected to a series of explosions—of wrath—from an infuriated person of the female persuasion, who vows that her health and temper are being ruined, that the very plants are being killed (and so they are!) that the table flowers last about two days instead of the two weeks they would do under electric conditions, that the silver would disgrace a pigstye, that the very dog is unhappy, and —various other things. We live in dread of being blown to Heligoland when the ancient and corroded chandelier gives out—(I positively refuse to get a new fitting); and altogether my feeling is that electricity at any cost for wiring and any price per unit is better than gas at a gift.

Even this is not all—for our particular supply of poisonous and explosive vapour has a way of choking-up the pipes with deposit, and insult has been added to injury on at least one occasion by a practically total failure. Thus candles have had to be requisitioned (fact!), and the evening meal on one occasion took as much gas to cook it as would blow up the Liberal Government, and as much time as would have sufficed to wire the whole house on the new patent lightning conduit method.

W. Perren Maycock.

London, S.E., *December 18th*, 1908.

Electricity from Refuse.

I have read with interest in your issue of December 4th, the working results of the combined Electricity and Destructor Works at Cambuslang, Scotland, where Mr. Abraham is the engineer.

The Fleetwood and District Electric Light and Power Syndicate, Ltd., can show results somewhat better than those at Cambuslang, and I have tabulated a statement of such for both undertakings.

Fleetwood is apparently a smaller town than Cambuslang, having less refuse to burn, but on the other hand, it has a much larger electricity supply business.

In order to properly compare the two plants, with approximately an equal number of units generated, I have had to take the Fleetwood figures from four weeks in May and June which are the lowest returns for the year. The Cambuslang returns are for December.

It is my usual practice to allow 250 units per ton of coal used including banking spare boiler, but for the purpose of this letter I am taking Mr. Abraham's figure of 150 units.

It is not the purpose of this letter to adversely criticise Mr. Abraham's results, but to show what is being done elsewhere. Mr. Abraham appears to get practically all the steam he needs from the destructor; no one can do better. All he requires now is more business to deal with.

	Cambuslang.	*Fleetwood.*
Date under review	Dec. 1 to 28	May 16 to June 13
Total units generated	13,792	15,445 (per meter)
Units generated from coal, at 150 units per ton	876	3,000
Units generated from refuse ...	12,916	12,445
Tons of coal burnt	5 tons, 18 cwt.	20 tons.
Tons of refuse destroyed ...	395 tons.	268 tons.
Units generated per ton of refuse	32·6	46·5
Wages to destructor stokers ...	—	240s.
Cost of labour per ton of refuse destroyed	1s.	10·7d.

The destructor in question was a two-cell top-feeding plant and was in continuous use from August, 1899, until October, 1908.

The boiler being somewhat small, and the brickwork considerably burnt after nine years' work, it was decided, upon my advice, to pull down the two cells and to rebuild them with a much larger boiler. This has been done, and the new plant will be set to work about January 1st, 1909. The old destructor boiler is now fired with coal, and the new boiler and cells have been built upon the space occupied by the old cells alone.

The new plant is provided with a regenerator and other up-to-date improvements, in addition to the larger heating surface of the boiler, and it is confidently expected that from 50 to 60 units will be generated per ton of refuse burnt.

I might say that another boiler was needed in any case, and the arrangement described, not only provided a new and improved destructor, but also saved lengthening the boiler house at considerable expense.

In order to ascertain the comparative value of the ordinary unscreened ashpit refuse as a fuel, very careful measurements have been made of the coal burnt during the time the destructor has been out of use, with a result that slightly over 300 Board of Trade units have been generated for each ton of coal used.

In large undertakings where there is sufficient refuse to keep six or eight cells in commission day and night, and where there is a continuous demand for electricity, far better results should be and are obtained. For instance, at Hackney an average of 124 tons of refuse is destroyed each day, and the average units generated per ton during one year were 50. These results were obtained for the year ending March 31st, 1906, and are the latest figures which I am able to lay my hands on at the moment.

The refuse in London as compared with that either in Scotland or the North of England is never so good from a calorific point of view, and in many cases the evaporative results obtained are 50 per cent. lower.

In order more accurately to compare the results obtained at Hackney with those shown above, I give the following weekly results, which are taken from the paper read by Mr. W. P. Adams before the Institution of Electrical Engineers on December 5th, 1904.

These figures are calculated by the deduction from the total units generated, of the amount of the units raised by coal upon the basis of 5 lb. of coal per unit generated; or, in other words, 448 units generated per ton of coal burnt. The figures are as follows:—

For week ending November 8th, 1902—	
Units generated from coal	8,713
Units generated from refuse	39,952
Units generated per ton of refuse	55
For week ending December 20th, 1902—	
Units generated from coal	12,835
Units generated from refuse	51,406
Units generated per ton of refuse	60
For week ending January 9th, 1904—	
Units generated from coal	23,700
Units generated from refuse	45,822
Units generated per ton of refuse	52
For week ending January 17th, 1904—	
Units generated from coal	23,565
Units generated from refuse	45,217
Units generated per ton of refuse	53·7

It might be well to point out that at Hackney, during the time when the above results were obtained, there were neither superheaters in connection with the destructor, nor any apparatus for the heating of the air used for forced draught.

I believe that superheaters have now been added to all the boilers connected to the destructor, and no doubt the results will have improved very considerably.

Oswin Hansom.

Fleetwood, *December 15th*, 1908.

Electrical Driving in Cotton Mills.

Having read Mr. Booth's interesting article on the above, and also his reply to "G. L." in your issue of December 11th, I am tempted to ask for a little space in which to discuss one or two points put forward by Mr. Booth. In the first place Mr. Booth informs us that he could easily apply a turbine to a rope drive by simply modifying the rope drums, shaft speeds, &c. From information supplied to me by leading turbine makers, I am given to understand that this is impossible of accomplishment on account of the high rotative speed of the turbine shaft, which runs at 3,000 R.P.M. I am fully aware that it can be done with small turbines not exceeding 300 B.H.P. by using an expensive system of gear wheels. I, for one, would welcome a rope-driving turbine, in fact, it is just the machine I have been looking out for, capable of developing 1,000 B.H.P., its efficiency, however, must not be less than a reciprocating engine of similar output.

I consider the estimates given by "G. L." a fair average for the last three years, if the estimates I have received during that period are anything to go by.

As regards the question of flexibility, there is more in the suggestion than appears at first glance; for instance, we in the cotton trade could very well do with shutting down 50 per cent. of our machinery at the present time, but on account of our mills being driven with one engine we gain practically nothing in doing so. Now I maintain that the only feasible way out of the difficulty is the electric motor, and so far as my poor judgment will allow, I would suggest two or more generating sets, depending on the size of the mill. I am given to understand that the gas engine would figure out well in such a scheme on account of the efficiency of the small engines being equal to the larger sizes, perhaps Mr. Booth will be good enough to enlighten us on this point.

Mr. Booth's sketches are of interest, and I quite agree with his remarks concerning the layout of textile machines in a mill; nevertheless, even here at times a little flexibility is good, especially if weaving is carried on; in some of our mills we have ring frames in our weaving sheds.

Now as regards overtime in a cotton spinning mill, this is no new thing. Often during the great boom it was quite a common thing to run the card room over, due to the production getting out of balance; in fact, accidents will happen even in a cotton mill which sometimes mean the stoppage of a whole room. Two mills quite close at hand had to run a portion of their blowing and card rooms,

through meal times and after hours in the evening for a considerable time before the slump came; therefore I consider that Mr. Booth is wide of the mark as regards the impossibility of working a cotton mill overtime.

We would all of us like to see belts and ropes dispensed with, as they are, at the best of times, a source of trouble and danger; besides, the cost of upkeep amounts to a considerable item.

Mr. Booth says he has nothing to say about old mills. I think it just as well. Perhaps he will be surprised to hear that at least 25 per cent. of the cotton spinning mills in Lancashire are gear driven. I would advise him to pay a visit to Oldham, when he has time to come down this way, and then he will find out for himself.

I don't think the electrical enthusiast need bother his brains about the new mills, as there is not much likelihood of any more being put up for years to come; in fact, if Mr. Booth would care to invest, I could put him in possession of a few empty shells; at the moment of writing there are just a few going-a-begging.

This would give him an excellent opportunity to show us how to do it, as we in Lancashire are not so sure yet whether Brown, Boveri have found the solution for operating ring frames; what holds good on the Continent does not always appeal to a Lancashireman. I confess we are a county of sceptics, but, so far, we have yet to be convinced. On the other hand, from examples we have seen of electrically operated mills in our immediate neighbourhood, we are bound to acknowledge that there is more in the idea than simply the question of running costs; in fact, some of my friends who have adopted it seem to have no difficulty in disposing of their yarn at remunerative rates on "'Change."

What we textile people are most frightened about is the question of reliability; and, on the other hand, we do not profess to be electrical engineers, therefore we must be excused somewhat on this score for our so-called conservatism.

With respect to the rope race, now it is an acknowledged fact that no sane individual builds a rope race just for the sake of having one attached to his mill; neither do we, when we want to build or extend our mills, buy a foot more space than we actually need, and if we could increase our spindles 1 per cent. in times of a boom we would do it, and the rope-way would have to go, if we could do without it; it costs money and it takes away from our light at that end where the main drives are situated. Mr. Booth will, no doubt, tell us to build outside the towns; the idea is a good one, but there are other things to be reckoned with, which I do not intend to mention at this juncture.

I do not wish to suggest that we textile people are all in favour of the electrical drive, but Mr. Booth will, perhaps, allow us to judge by results.

I quite agree with Mr. Booth that no good is being done by putting forward erratic statements by either side, such, for instance, as the idea of putting a motor on each spindle, and one, I suppose, on to each draw roller, a very nice combination indeed. Has Mr. Booth's electrical friend given this question any consideration at all? Truly the world does consist of wise men and fools.

Textile Engineer.

Royal Exchange, Manchester, *December 15th*, 1908.

Meters for Tramcars.

With reference to your editorial note under this heading in your last issue, we think it will interest tramway managers to know that Mr. Spencer's condemnation of the time meter as a means of saving current is by no means universally shared. On the contrary, it was judged favourably by British tramway managers at the recent Congress of the Municipal Tramways Association, when Mr. Mozley—among others—stated that after 12 months' trial with time meters, he had decided to apply this system of control to every car in the service, for his prolonged experiments had resulted in a saving of no less than 14 per cent. of energy. The general opinion at the Congress seems to have been that time meters are decidedly more suitable for the rough service of the tramcar than watt or ampere-hour meters, besides being cheaper, more accurate, and less liable to get out of order.

As regards your lamentation that your persistent appeals for the use of meters on cars, have met with so meagre response, we are pleased to inform you that our order books prove that tramway managers are getting alive to the facts:—

That the most important factor in the current consumption is the driving; that the driver is the great current waster and that some method of check on each man is necessary; that time meters are most suitable to carry out such control of the drivers, and that the economies so produced are enormously in excess of the cost of the apparatus.

The "Acme" Meter Co.,
N. Gunz, *Manager.*

London, E.C., *December 19th*, 1908.

Colliery Electrical Engineers.

Reading your leading article in the Electrical Review of December 11th on "Electrical Fatalities in Collieries," I quite agree with you that we colliery electrical engineers should have a society to protect and further our interests, and the sooner we get "incorporated" the better. I myself, having 10 years' experience as a colliery electrician, shall be pleased to assist any association that might be formed as much as possible.

P. D. Coates.

Burnley, *December 15th*, 1908.

An engineer who is laying down some 2½ miles of four-wire three-phase network would be glad if any of our readers could point to any similar networks to supply districts at present in use, or being laid down in this country.

A letter on the L.C.C. turbines appears in our "Notes" to-day.

PROCEEDINGS OF INSTITUTIONS.

Output and Economy Limits of Dynamo-Electric Machinery.

By J. C. Macfarlane, M.I.E.E., and H. Burge, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *London, December 10th*, 1908.)

The object of this paper is to point out:—

(*a*) The factor that limits the output to be obtained from a given core size of a medium-speed dynamo-electric machine.

(*b*) To indicate, by means of diagrams, what is approximately present-day practice with regard to this.

(*c*) To indicate the directions in which extension of this output limit and economy in active material may be expected.

The best dynamo-electric machine is the one which complies with the specified conditions, with the least possible weight, size and cost. By designing in accordance with the methods set forth in this paper these economies will be obtained, and will lead to increased efficiency and greater mechanical security.

Direct-current dynamos and motors, and three-phase alternating-current dynamos and motors only are considered.

Since the introduction of the interpole, the output that can be obtained from a given core size is no longer governed by the sparking limit, but depends on the permissible temperature rise.

If x = total electric loading of the armature (ampere wires) and y total magnetic loading (c.g.s. lines), then

$$\frac{\text{watts output}}{\text{revs. per min.}} = \frac{x\,y}{60 \times 10^8}.$$

If d = diameter of armature at face (inches), l = net length of core without ventilating ducts (inches), B = flux density in air-gap (c.g.s. lines per sq. in.—magnetic loading intensity), q = electric loading intensity (ampere-conductors per inch of periphery of armature), ψ = ratio of pole arc : pole pitch, then

$$d^2 l = \left(\frac{60{\cdot}8 \times 10^7}{B \times q \times \psi}\right) \times \frac{\text{watts}}{\text{R.P.M.}},$$

where the part in brackets is the output factor. For a given ratio of pole arc to pole pitch, the product of the electric and magnetic loading intensities is proportional to the watts per revolution per $d^2 l$.

In the diagrams, figs. 1 and 1A—

Quadrant 1 gives the relation between the output per revolution and the product of the magnetic and electric loading intensities ($B \times q$).

Quadrant 2 gives the relation between the output per revolution and the size of the armature core (the $d^2 l$).

Quadrant 3 gives the relation between the diameter of the armature and the $d^2 l$ value of the armature for various numbers of poles, on the assumption that the poles have square faces.*

Quadrant 4 gives the relation between the diameter and length of the machine for any number of poles, and square pole faces.

In making up these diagrams, a large number of inter-pole

* By a square-pole machine is meant a machine in which the polar arc is exactly equal to the net length of the armature core.

machines of modern design were considered; the output was reduced to watts per revolution, and to 70 per cent. ratio of pole arc to pole pitch, and also in direct proportion to the ratio—core length for square poles : existing core length, and from the formulæ $l = 0{\cdot}7\ \pi\ d/p$, and $d^3 = d^2l\ p\ /0{\cdot}7\ \pi$, where p = the number of poles, the core lengths and diameters for selected d^2l values and numbers of poles have been calculated and set down in the respective quadrants of the diagrams.

These diagrams enable the values of the product of the electric and magnetic loading intensities, the d^2l value, and the diameter and length of the armature core of a machine having square pole

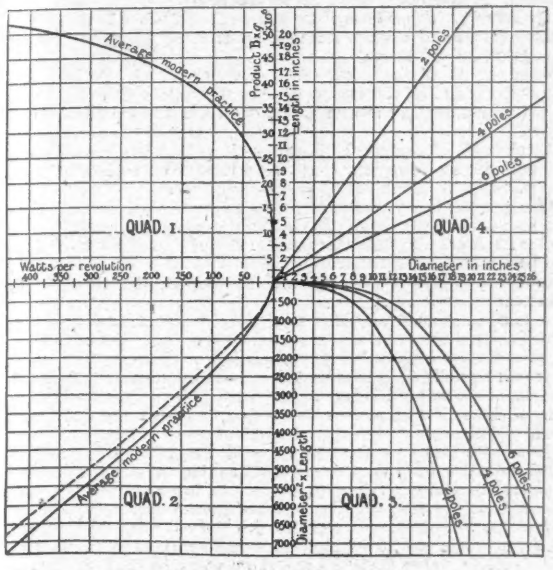


Fig. 1.—Relation between Output Factors and Armature Core Dimensions for Small Square Pole-Face Dynamos. (Average Modern Practice.)

faces, to be obtained at a glance for any selected value of the output, and for any number of poles; this core size will only be large enough to give the selected output with a temperature rise not exceeding 75° F., provided the armature is fairly well ventilated, and provided the sum of the losses in the armature does not exceed the value obtained from the curve, figs. 2 and 2A, corresponding to the d^2l value found.

Conversely, if a certain core size is given, the output that can be obtained therefrom at a certain speed, and the value of the watts that can be dissipated on the armature in order to ensure not more than 75° F. temperature rise can be found.

If the number of poles is known, by working backwards from the diameter of the core, we can find from the diagrams figs. 1 and 1A the net iron length of a core necessary for a square pole face; the d^2l value for this core; the watts per revolution, and therefore the output at the required speed, and the product of the electric and magnetic loading intensities.

As the d^2l is known, we can find from figs. 2 and 2A, the maximum watts the armature can dissipate without exceeding 75° F. rise; but it will not necessarily follow that the loss estimated above will not be exceeded.

The information necessary to plot the curves in figs. 2 and 2A was obtained from the average test results of large numbers of machines of different makes, all the results being reduced to 75° F. temperature rise, and to the peripheral speeds given in the diagrams. The armature losses obtained from the curves are only suitable for open-type machines; a reduction of approximately 10 per cent. should be allowed if the machines are of the protected type and well ventilated.

In order to increase the output per d^2l, it will be necessary to increase the product $B \times q$, the value of which depends on the value of the slot space factor; for constant losses in the armature winding it varies directly as the square root of this factor. For a good slot factor, the number of slots per pole should be small and the depth of the slot great.

The limiting value of depth of slot for a maximum output is obtained when the possible increase of the electric loading intensity is just compensated by the decrease in the magnetic loading intensity, due to cutting away the teeth at the roots.

When working at constant density at roots of teeth, the maximum value of the product $B \times q$ occurs when the net width of copper in the slot is equal to the width of iron at the root of the tooth, and when the depth of slot is approximately equal to one-sixth of the armature diameter. It is impossible in large machines to make the slots as deep as here indicated, but there appears to be no good reason why slots should not be made deeper than they are at the present time.

It has been seen that the total magnetic loading varies in inverse proportion to the total electric loading on the armature for a constant output; the amount of material in the magnetic circuit, *i.e.*, the iron and shunt copper, varies almost directly with this loading. Also the amount of material in the electric circuit, that is, on the armature and interpole windings, varies approximately in direct proportion with the electric loading. From the above it is obvious that there is some value for the ratio of the total magnetic to the

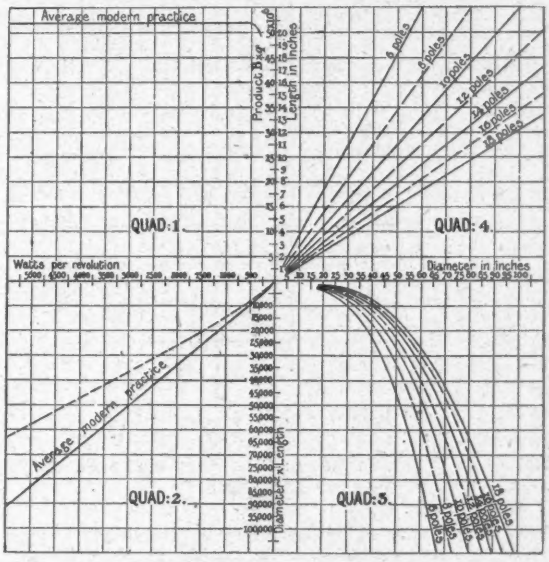


Fig. 1A.—Relation between Output Factors and Armature Core Dimensions for Large Square Pole-face Dynamos. (Average Modern Practice.)

total electric loading, which makes the cost of the active material for any machine a minimum. The authors find that the cost of active material is a minimum when the cost of the material in the magnetic circuit is equal to the cost of the material in the electric circuit, and this occurs when the ratio of the total magnetic to the total electric loading lies between 250 : 1 and 350 : 1.

The efficiency is a maximum when the loss in the magnetic circuit is approximately equal to the loss in the electric circuit, and this occurs when the ratio of the total magnetic to total electric loading is approximately the same as for the cost minimum.

The following prices were assumed :—

Armature iron	...	...	...	34s. per cwt.
Pole stampings	...	...	...	22s. „
Effective yoke steel	...	...	...	18s. „
Copper	...	...	...	1s. per lb. overall

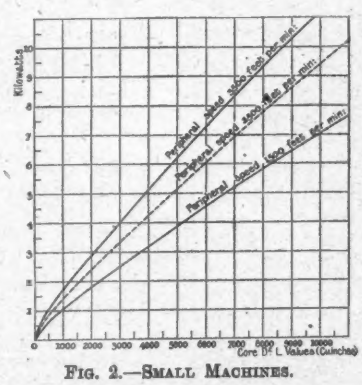

Kilowatts
Peripheral speed 4000 feet per min.
Peripheral speed 3000 feet per min.
Peripheral speed 1800 feet per min.
Core D² L Values (Cu inches)

Fig. 2.—Small Machines.

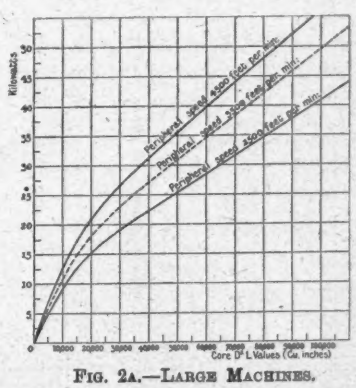

Kilowatts
Peripheral speed 4000 feet per min.
Peripheral speed 3000 feet per min.
Peripheral speed 1800 feet per min.
Core D² L Values (Cu. inches)

Fig. 2A.—Large Machines.

Permissible Kilowatts Loss in Armature—As a Function of the Core Size.

In order to obtain an equation by which the iron losses could be readily estimated, tests were made which showed that the core loss varied approximately as the 1·3 power of the frequency, and approximately as the second power of the density; therefore if—

v_t = volume of the iron in the teeth in cubic inches,
v_i = volume of the iron in the core in cubic inches, and
w = total watts loss on the armature, then—

$$w = f^{1\cdot3}\ (v_t B_t^2 + v_i B_i^2) \times 3 \times 10^{-12}.$$

The equation gives very good results when the densities in the armature teeth and core are fairly high.

In quadrant 2, figs. 1 and 1A, are given dotted line curves which show the increased outputs which may be expected from machines

designed on these lines, the permissible losses being taken from curves figs. 2 and 2A, and the densities at the roots of the teeth being fixed at 135,000 C.G.S. lines per square inch. The actual iron losses were checked by the equation given above.

With interpole machines the commutator can be made much smaller than with non-interpolars, because of the diminished brush contact loss. The diameter is only limited by the mechanical thickness of the plates, and the proximity of the brush arms of opposite polarity to one another. For ordinary interpole dynamos the average E.M.F. between the bars should not exceed 25 volts.

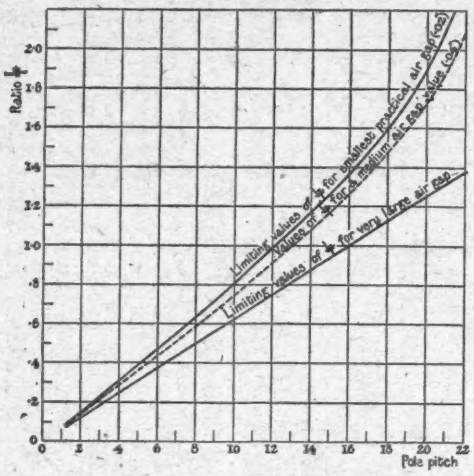

Ratio l/τ
Pole pitch
Limiting values of l/τ for smallest practical air gap (cold)
Limiting values of l/τ for good medium air gap (value cold)
Limiting values of l/τ for very large air gap

FIG. 3.—RATIO IRON LENGTH L: POLE PITCH T AS A FUNCTION OF THE POLE PITCH.

With regard to the field system, it need only be stated that good proportions for the interpole section are 50 per cent. of the core lengths and 15 per cent. ratio of pole arc to pole pitch. With these dimensions the M.M.F. provided on each interpole should exceed the armature M.M.F. per pole by about 30 per cent.

By using the proper multiplying factors the diagrams figs. 1 and 1A apply equally to direct-current motors and rotary converters.

INDUCTION MOTORS.

Unlike the direct-current machine, the core size of the asynchronous motor is not usually limited by heating considerations, but by the value of the leakage factor, on which the value of the maximum power factor depends. The leakage factor will be defined for this purpose as the ratio of the ideal light-load current to the ideal short-circuit current.

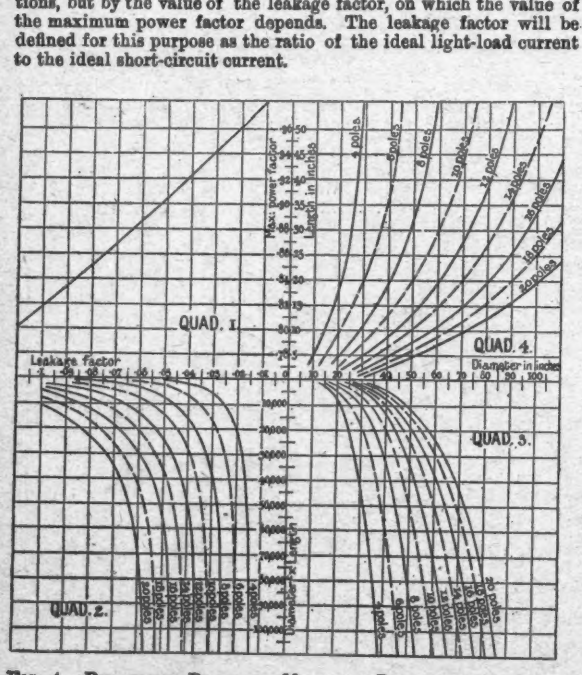


FIG. 4.—RELATIONS BETWEEN MAXIMUM POWER AND LEAKAGE FACTORS AND PRINCIPAL CORE DIMENSIONS FOR INDUCTION MOTORS.

It is shown in the paper to be—

$$\sigma = 1{\cdot}05\,\Delta\,(46\,l + 2{\cdot}8\,\tau^2) \div \tau^2\,l,$$

where Δ is the total equivalent length of air-gap,

l is the net length of stator core without ventilating ducts, and

τ is the pole pitch, all in inches.

The actual air-gap length varies from 0·02 in. in the smallest motors to 0·05 for d^2l = 10,000, and 0·09 for d^2l = 100,000. The number of slots per pole per phase is assumed to vary as the pole pitch, in the ratio 6 : 10.

The upper curve, fig. 3, has been plotted for an actual air-gap value 0·02 in. The best value of core length ÷ pole pitch for any pole pitch lies nearly on the upper curve, when the air-gap is small, and when the air gap is large lies nearly on the lower curve. The intermediate curve has been drawn for a medium actual air-gap value = 0·04 in., and the values of d, l, in the diagram, fig. 4, have been estimated from this curve as a basis.

In the diagram, fig. 4:—

Quadrant 4. If τ is the independent variable, the values of l for known values of τ are obtained for the intermediate curve, fig. 3, and the values of d for selected numbers of poles, and for the known values of τ, have been calculated and set down.

Quadrant 3. d and l are already known, and the d^2l values for known values of d and the selected numbers of poles have been calculated and set down.

Quadrant 2. From known values of τ and l, and calculated d^2l values for the selected numbers of poles, the values of σ set down in this quadrant have been calculated from the equation given above.

Quadrant 1. For selected values of σ the values for the maximum power factor set down in this quadrant have been calculated from the well-known relation $\cos\phi = (1 - \sigma)/(1 + \sigma)$.

The diagram shows at a glance the maximum power factor that can be commercially obtained from any core volume, provided the motor has a wound rotor and is designed with the number of slots per pole per phase and the air-gap as given in the paper, a ratio of core length to pole pitch nearly in accordance with the curve, fig. 3, and nearly closed slots.

A motor designed as above would be a good commercial motor, which could be adopted as a standard for comparing power factors, and the sizes of such motors for given outputs.

It will be sufficiently near to take the curves, quadrants 2, figs. 1 and 1A, of d^2l values for direct-current machines as the limit to the size of induction motors for any output, provided the size is not already limited by power-factor considerations.

In many cases, especially when the number of poles is small, it is possible to reduce the core size until the limit of output is that of temperature rise only, thereby gaining an increase in the over-all efficiency of the motor, and an increase in the mechanical security, in that the peripheral speeds and span of the rotor coils are reduced to a minimum, and it will be possible to make the shafts and frames stiffer. On the other hand, there will be a slight reduction in the maximum power factor.

With two-pole motors the authors consider that a fractional pitch of 50 per cent. should be used in almost every case, as this is easily obtained by winding the motor for four poles and reversing one of the coils in each phase. But this is almost the only case in which the use of the fractional pitch winding is advantageous.

(To be concluded.)

Domestic Electricity Supply (including Heating and Cooking) as Affected by Tariffs.

ON December 8th, MR. W. R. COOPER read his paper on this subject before the Glasgow Local Section of the I.E.E.

MR. SAM MAVOR (Glasgow) said he did not see any great difficulty in having a two-meter supply, as the duplicate circuit, from the nature of the case, would only be required in a few rooms in the house. His experiments with electrical heating and cooking apparatus, even in cases where first cost did not count, had been a failure. The ordinary electric radiator was inadequate to heat a moderate-sized room. The consumer would not tolerate the periodical inspection of his installation. He thought that the Corporation should hire out electrical apparatus, say, on a three months' trial, free of charge, supplying the current from the lighting circuit, and if it were found satisfactory, the necessary wiring might be proceeded with later.

MR. ROBERTSON (Greenock) said the maximum demand system had been responsible to a considerable extent for hampering the growth of demand. Some of its drawbacks had been got over in Glasgow by basing the initial charge on a two hours per day maximum and giving domestic consumers a flat rate. Owing to the differences in rateable values he did not think the Norwich system was feasible. The system of charging according to the number of lamps installed was objectionable, particularly for the class of consumer referred to in the paper. If there was to be a departure from the flat rate at all, he thought the double-tariff rate was the best system.

MR. SILLERY (Partick) said that the Partick Electricity Committee had installed an electric water heater in the Burgh Halls, and consumers were invited to come and see it.

MR. J. D. MACKENZIE (Glasgow) said he had that day examined an electric water boiler in Glasgow, and found that it took 3s. 1½d. worth of electricity to heat 60 gallons of water, whereas with a gas heater this could be done for 1s. 6d. He thought that a flat rate all round was the proper system of charging.

MR. CALDWELL (Glasgow) gave particulars of a London installation of electric cooking in a restaurant, where it was found that certain kinds of meat could be got ready more quickly without deterioration than with either gas or coal heating.

MR. HANCOCK (Glasgow) said that the electric flat-iron was quite an efficient apparatus, and he thought that laundries could be made a good source of revenue for the station engineer. Electrical apparatus for laundries commended itself in so far as it gave off no noxious fumes such as were condemned in other devices, under the Factory Act.

The Chairman (Mr. W. W. Lackie) asked whether the wiring for the heating and power circuits was a serious matter. He was strongly of opinion that whatever system of charging was adopted it must be based on the maximum demand system. In two houses in Glasgow, each with a rateable value of £130, the annual account in the one case at present was £4 19s. 9d. and in the other £19 14s. 9d., both on a flat rate of 3½d. If they charged 10 per cent. on the rateable value and 1d. per unit, the first man would require to pay £14 2s. and the second, £20 10s. Taking two smaller flats, A paid at present £3 and B, £9 5s. per annum. If 10 per cent on rateable value and 1d. per unit were charged, A would pay £7 and B £9. The assessment principle he thought was wrong, and in his opinion illegal. A simple method of getting over the two-meter question would be to charge all units used in November, December and January at a flat rate of 4½d., and all units used throughout the year on a flat rate of 1d.

Other speakers took part in the discussion.

Mr. Cooper, in reply, said his critics seemed to have overlooked the need for the simplification of systems of charging. A certain system or systems might be quite just and equitable, but they were condemned because they were so complicated. He maintained that the backward state of the electrical devices on the market was due to high tariffs, and makers had very little encouragement given them to push their wares, owing to the difficulties in their path from that point of view. He did not think that the time had yet come for a flat rate, but he only wished to draw a distinction between lighting and power supplies. He advised that small and inexpensive electrical devices such as the flat-iron should be tried first. The Newcastle Co. as the result of giving public demonstrations of the working of electrical cooking apparatus had already a load of 18 kw. from consumers using heaters and cookers.

PARLIAMENTARY.

Damage to Atlantic Cables.—Mr. Bolend inquires in the Parliamentary Papers, of the Postmaster-General, whether his attention has been called to the continued damage caused to the Atlantic cables off the coast of Ballinskelligs, County Kerry, by trawlers; and whether, in view of the representations made by the United States Government and the Chambers of Commerce in the United States and England on this subject, he will use his influence to have these trawlers excluded from the cable zone, within which 13 cables are laid, to a distance of about 15 miles from the shore. Mr. Sydney Buxton, in reply, states that his attention has been drawn to recent further cases of damage to the Atlantic cables off the coast of Kerry which are attributed to trawlers. In consultation with the President of the Board of Trade he appointed a committee last summer, which carefully investigated the whole question. The committee had before it a proposal made by certain of the cable companies that trawlers should be excluded from an area extending some 70 miles from the shore (not 15 miles, as suggested in the honourable member's question), in which damage attributed by the companies to trawlers had occurred. The committee considered this proposal impracticable, a view in which His Majesty's Government concur. It reported, however, in favour of an alternative proposal made by certain cable companies for the inspection of trawling gear, and the practical steps to be taken to give effect to this recommendation are now under the consideration of the departments concerned.

Preston, Chorley and Horwich Tramways.—By the Bill which has been deposited by the Preston, Chorley and Horwich Tramway Co., it is proposed to authorise the company to extend the period for the construction of works, &c. The company was incorporated in 1903, and now seeks to construct a portion of Tramway No. 2 authorised by that Act. It is also sought to reduce the share capital from £500,000 to £425,000 and the loan capital from £125,000 to £106,250. The company may issue any portion of the capital, not exceeding £200,000, as preference shares bearing interest not exceeding 6 per cent. per annum. By Clause 20 it is provided that the company may enter into an agreement with the Corporation of Bolton for a lease to the company, or for the purchase by the company, of so much of the existing tramway belonging to the Corporation as is situate within the township of Horwich. Clause 23 provides for running powers over certain tramways of the Corporations of Bolton, Preston and Wigan. Under Clause 30, power is taken to supply electricity in bulk to any Corporation, local authority or person requiring the same and being upon the line of route traversed by the tramway.

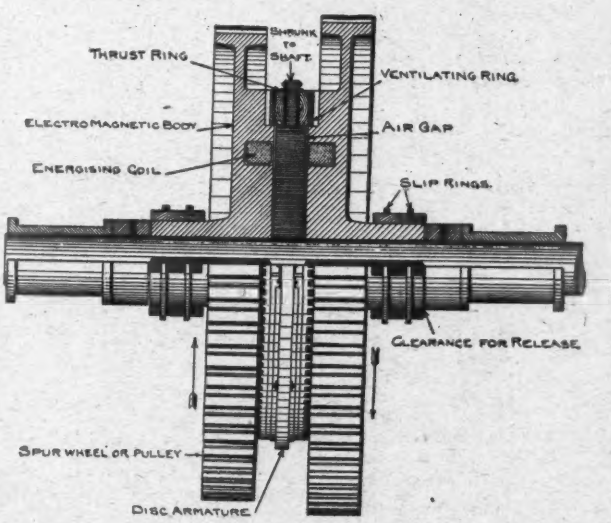
Transfer of the National Telephone Co.—In Friday's Parliamentary Papers, Mr. Steadman asks the Postmaster-General if he can state how and to what extent, if at all, the seniority of the London sorting force is likely to be affected by the transfer of the staff of the National Telephone Co. to the Post Office in 1912; and, what claim, if any, has the National Telephone staff on the Postmaster-General which has caused him to issue a warning to his present staff, already civil servants, that the latter's prospects are likely to be affected. Mr. Sydney Buxton replies that it is not yet possible to state how the various questions will be solved which are likely to arise in regard to the relative status and seniority of the staff now employed in the Post Office and that to be taken over from the National Telephone Co. The London sorting force, however, will be in no way affected. As it is certain that questions of difficulty will arise, he thought it right to issue a general warning to new entrants and officers newly promoted that their seniority might be affected. At the same time he stated definitely that every care would be taken to prevent hardship.

York Town and Blackwater Electric Lighting.—The York Town and Blackwater Gas Co. have deposited a Bill in Parliament in which Frimley, Hawley, Sandhurst, Crowthorne, Finchampstead and Wokingham are scheduled as an area for the supply of electricity. It is proposed to change the name of the company to that of the York Town, Blackwater, Camberley and District Gas and Electricity Co. Additional capital to the extent of £50,000 will be raised.

BUSINESS NOTES.

Electromagnetic Clutches.—We give below some particulars of the Vulcan electromagnetic clutch, which can be made up to 2,000 b.h.p. for a main roll reversing drive, and for which Messrs. C. E. Lugard & Co., of Wilson Street, Middlesbrough, are the English agents. The illustration shows a reversing clutch consisting of an electromagnetic body, running loose on the shaft; an energising coil, wound for any convenient voltage; slip-rings, for conveying the current to the coil; a disk armature, fixed to the shaft; a thrust-ring, fixed to the armature; and a ventilating ring, fixed to the magnetic body. When continuous current is supplied to the energising coil, either from the supply mains or a special exciter, through the slip rings, both parts of the clutch are held in position by magnetic attraction. The magnetic faces of the clutch are kept apart by a thrust ring, which leaves an air-gap between them.

These clutches can be made for any horse-power and speed, and for severe drives, ventilated rings, or water cooling, is employed to



Vulcan Electromagnetic Clutch.

dissipate the heat generated. The chief advantage claimed for these clutches over clutches of the friction type, is that they can be made certain in action, be arranged to slip at any predetermined torque by varying the excitation, without fear of damage to the faces, and are quite independent of lubrication. We understand that over 500 clutches, transmitting a total of about 12,000 b.h.p., are in successful operation, and the following examples will give an idea of the conditions under which they are working: Main roll drive—1,000 b.h.p., 130 b.p.m., working for two years on a finishing mill; marine propulsion—600 b.h.p., 350 b.p.m., arranged so that the engine runs at a constant speed, the clutch slipping to vary the speed of the vessel; machine tool—500 b.h.p., 400 b.p.m. on a drawing bench, reversals taking place about every nine seconds; planing machine—heavy planer, 8 ft. × 8 ft. × 40 ft., cutting speeds 15 and 45, return 102 ft. per min., four tools. This machine will take about 43 tons on the table. We understand that over 140 planing machines alone have been fitted with these clutches.

Arc Works Sick Benefit Society.—The annual general meeting of the Arc Works Voluntary Sick Benefit Society was held on Saturday, December 12th, in the recreation room at the Arc Works. Mr. A. J. Hodgson, presided, and he was supported by Mr. Claud Crompton. The balance-sheet was read by the secretary (Mr. W. G. Bickmore), and was unanimously adopted. The chairman then read the report for the year, which showed that the contributions to the general fund amounted to £301, the donations from Messrs. Crompton & Co., Ltd., for additional sick pay, were £87, making with the balance of dividend brought forward from the previous year, total receipts to the general fund of £389. The expenditure had been by sick pay, £312; compensation for loss of time owing to contagious disease at the members' home or lodgings, £4 0s. 6d.; and management expenses, including printing, stationery, postage, officers' salaries, &c.,

£19 10s. 10d., making a total of £336, leaving a balance for distribution amongst the members of £53. The society had lost, through death, four members, and one member's wife, and the funeral levies had amounted to £120, or an average of nearly £27 for each member, and £12 5s. for the member's wife. The total receipts amounted to £509, as compared with £446 in the previous year. The reserve fund showed a balance at the bank of £144, or an increase of £1 16s. on the year. The report was unanimously adopted. The Committee's recommendation that the balance over the £100 standing to the credit of the reserve fund, viz., £14 7s. 1d., be sent as a donation to the Essex and Chelmsford Hospital enlargement fund was unanimously adopted. At the close of the business of the Sick Benefit Society, the annual meeting of the subscribers to the Arc Works Infirmary and Dispensary Fund was held, Mr. A. J. Hodgson in the chair. The chairman drew the attention of the meeting to the Arc Works Benevolent Fund, which is supported entirely by the company, and is intended to relieve deserving cases of necessity, such as, for example, where an employé had been ill for an excessive length of time, and where, in the opinion of the directors, a small grant would enable him to tide over his difficulties. A hearty vote of thanks was accorded to the directors of Messrs. Crompton & Co., Ltd., for their generous support of, and the kindly interest taken by them in, all the institutions of the Arc Works. The chairman replied that the directors were always ready and pleased to assist by every means in their power, any object which was conducive to the welfare and comfort of their employés.

Refrigerating Plant.—The neat little refrigerator described on p. 951 of our issue of November 27th has attracted much attention, and we have received many inquiries for the name of the maker. It appears to be made by Messrs. Sigrün, of Epinal, France. We suggest that some British manufacturer should take it up.

Spain.—According to *Electron* an English company, the Electrolytic Co. (Spain and Portugal), Ltd., proposes to establish in the province of Huelva a model factory for the treatment of copper ores, liquid cements, &c., by the Lafontaine hydro-electric process. The capital of the company is £255,000, £30,000 of which is to be paid to the Société Française Electrolitique for the use of the patents.

Angold Magazine Lamps.—The exterior of the buildings of the General Electric Co., Ltd. (71, Queen Victoria Street, E.C.), is illuminated by four Angold Magazine Flame arc lamps which burn 55 hours with one trimming, and a very effective demonstration they form for the members of the City Corporation, and for the passers-by, of the sort of lighting that ought to be adopted for all the City streets. We have received a picture showing the effect, but views of this kind never can do justice to the original illumination, and the effect is better seen in Queen Victoria Street than it would be in the pages of the Electrical Review.

Meeting of Creditors.—Thomas Ward, late director of the Electrical Instrument Manufacturers, Ltd., 22, Totteridge Road, Enfield Wash, Ponder's End, late Freezywater, Waltham Cross, Herts.—A meeting of the creditors in this case was held on December 17th, at 14, Bedford Row, W.C., for the purpose of considering a proposal by the debtor for the payment of a composition of 7s. 6d. in the £. The Official Receiver reported that the proposal was as follows:—That payment in priority to all other of the debts directed to be so paid in the distribution of a debtor's property shall be provided for as follows: Payment thereof within two months. That provision for payment of all costs and expenses incidental to the proceedings shall be paid within four months. That a composition of 7s. 6d. in the £ be paid within six months, and that the payment of preferential debts and the costs and charges, and of the composition, be secured by the joint and several promissory notes in the name of the debtor and Mr. C. J. Comerford, of 34, Bouverie Street, Fleet Street, E.C. The liabilities, according to debtor's statement, amounted to £1,161, and debtor did not estimate that the assets would realise anything. The Official Receiver pointed out that he had to be satisfied as to the financial responsibility of the person guaranteeing payment of the composition, and if he was not satisfied it would be his duty to report to the Court that the terms of the proposal were not fair and reasonable, not calculated to benefit the general body of creditors, and did not provide reasonable security for payment of the composition. At the meeting the creditors resolved to accept the composition.

Dissolutions and Liquidations.—Messrs. Meldrum Bros., Ltd.—Creditors should send particulars of their debts, &c., to Mr. T. Gregory, 3, York Street, Manchester, the liquidator, by February 16th.

Sevenoaks Motor-Car and Electrical Co., Ltd.—Creditors must send particulars of their debts, &c., to Mr. A. P. Guerrier, 126, Gresham House, E.C., the liquidator, by January 31st.

Messrs. Bowyer & Hodson, motor, electrical and agricultural engineers, Stansted and Takeley.—Messrs. R. E. Bowyer and J. Hodson have dissolved partnership. Debts will be attended to by Mr. Bowyer.

Messrs. Satchwell & Gittings, electrical fittings manufacturers, Tantarra Electrical Works, Walsall.—Messrs. H. Satchwell and A. E. Gittings have dissolved partnership. Mr. Gittings will attend to debts and continue the business.

Messrs. Revy Phillips & Co., general and electrical engineers, 181, Queen Victoria Street, E.C.—Messrs. J. W. Revy and P. F. Besch have dissolved partnership. The business will be carried on in future by Revy Phillips & Co., Ltd.

Correction.—A slight misprint occurred in our note on "Ball Bearings" last week, the letters "D.W.F." appearing as "D.V.F."

Bankruptcy Proceedings.—George Sutcliffe (George Sutcliffe & Co.), electrical engineer, 22, Church Street, Abertillery, Mon. Receiving order made December 16th on debtor's own petition.

W. J. Aubert, gas and electrical engineer, late 16, Harp Alley, E.C., present address unknown.—Mr. L. B. Linnett, 42, Poultry, E.C., was appointed trustee on December 15th.

Book Notices.—"Fire Tests with Textiles." Red Books of the British Fire Prevention Committee, No. 129. London: British Fire Prevention Committee. 1908. Price 2s. 6d.

"The *Practical Engineer* Pocket Book and Diary, 1909. London: Technical Publishing Co. 1909. Price, cloth, 1s. net; leather, 1s. 6d. net.

"La Telegraphie sans Fil." By A. Turpain. Second edition. Paris: Gauthier-Villars. 1908. Price 19 fr.

"Some Electro-Chemical Centres." By J. N. Pring. Manchester: Sherratt & Hughes. 1908. Price 1s. 6d. net.

The *Irish Builder and Engineer* shortly attains its jubilee, and the event is to be celebrated next March by a special jubilee number in which will appear a retrospect of the last 50 years of building, engineering, electric lighting, &c., in Ireland.

Catalogues and Calendars.—The London Electric Firm, George Street, Croydon.—Show-card illustrating their well-known arc lamp couplings, also a number of street arc lamp suspensions. Incidentally, we discover at foot a neat and very unobtrusive calendar for 1909, with tiny monthly slips.

From the Electric Construction Co., Ltd., we have received two very acceptable souvenirs, one taking the form of a match-box with the E.C.C. monogram forming part of an artistic design upon it; the other being a substantial piece of india-rubber with the company's celluloid band about it. These souvenirs will keep the name of the company green in the mind of many an engineer, as in lighting his pipe he has recourse to his E.C.C. matchbox, and other things being equal, he will rub out other names with the rubber sent for that purpose.

Messrs. James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, E.C.—28-page publication, entitled "Fan Notes," and containing a good deal of information, reprinted from an American engineering journal, relating to, and various illustrations and diagrams of interest in connection with, the design, construction, efficiency, &c., of fans.

Messrs. Lassen & Hjort, 52, Queen Victoria Street, E.C.—Pamphlet containing extracts from a number of testimonials received from users of their water-softening and purifying apparatus, among them being a number of electricity works, mills and factories.

Messrs. G. & J. Weir, Ltd., Cathcart, Glasgow.—We have received a useful pocket diary and note book from this firm. The opening pages contain particulars of some of the firm's manufactures—feed and other pumps,. with tabulated data serviceable in connection with same, and some of Letts's general tables follow. The memoranda portion is arranged apart at the other end, and has a pocket containing insurance policy.

Messrs. Simplex Conduits, Ltd., of Charing Cross Road, W.C., are sending out to their friends a polished brass plate with Simplex design in the centre and a thermometer curved beneath this design. This thermometer may serve a double purpose, one being to keep the recipient's interest in, and affection for, Simplex conduits at fever heat.

Mr. Harry Nance, electrical manufacturers' agent, 4, Church Street, Cardiff, has sent us a small hanging calendar with monthly slips. The latter, however, are soon forgotten in contemplation of the beautiful colour photo print that appears above it, and much as we may fight against the feeling, the bewitching glance of the fair creature who forms the subject of it will slay us many a time during 1909, and while we edit the Electrical Review we shall be compelled to open our heart and let this "Sunshine" in.

Babcock & Wilcox Electric Cranes.—Messrs. Babcock & Wilcox, Ltd., of Oriel House, 30, Farringdon Street, E.C., have sent us a catalogue relating to electrically-operated cranes. It will be remembered that they acquired the old-established business of Messrs. Wimshurst, Hollick & Co., Ltd., and retained the services of their technical staff, and some three years ago transferred their entire business to the works at Renfrew, where they have built and equipped with up-to-date machinery special crane shops for the manufacture of all types of electrically-operated cranes. The firm are not manufacturers of electrical equipment, but they are prepared to supply any type or make of motor and other electrical equipment, for which clients may have a preference. Messrs. Babcock & Wilcox have at present under construction two large transporters for the trustees of the Clyde Navigation, which will be two of the largest machines of this type in England. They are approximately 218 ft. in length, and the height from the rail level to the underside of the boom is 60 ft. They are capable of handling a load of 4½ tons at a time, giving a total capacity for each transporter of 120 tons per hour of coal or similar material. The firm are also just completing on behalf of the British Admiralty 13 overhead travellers, built to their usual strict specification, and are further supplying cranes to the order of the General Post Office and other Government Departments, while orders have been received from the Government of New South Wales, Cape of Good Hope and the Canadian

Department of Railways, &c. A speciality has been made of electrically-operated capstans, an illustrated description of which appears in the catalogue before us. The machinery portion of the capstans is enclosed in a cast-iron water-tight box. Special provision is made against the condensation of water on the inside, and the whole is arranged so that all parts of the machinery are easily accessible for inspection, &c. The firm have further sent us a pamphlet containing a reprint of an article on "Modern Electric Crane Practice," by Mr. Hollick.

B.T.-H. Power Installation Work during 1908.—The following is a list of some of the more important motor installation contracts secured by the power and mining department of the British Thomson-Houston Co., during 1908:—

Carling How Mines (Durham).—Five three-phase motors, 6½ to 175 H.P., aggregating 321½ H.P., together with controllers, switchgear, mechanical gearing, emergency brake and three-throw ram pump.

Sheffield Coal Co.—One 250-KW. A.C. generator, seven three-phase motors, 30/80 H.P., total 320 H.P., controllers, resistances, transformers and switchgear.

Joshua Whiteley & Co., Ltd., Albion Mills, Huddersfield.—Twenty-three three-phase motors, 6/55 H.P., totalling 928 H.P., together with switchboards, control panels, necessary wiring, &c.

J. & P. Coats, Ltd., Glasgow.—Eight three-phase motors, 300/325 H.P., total 2,600 H.P., with controlling gear, panels, &c.

Pease and Partners, Darlington (for Esh Colliery).—One 125-K.V.A. generator, one 45-H.P. and one 70-H.P. motors (total 115 H.P.) with switchboard, controllers, and resistances, also two (not for Esh Colliery) 15/25 H.P. motors, total 40 H.P., control panels, &c., also two 25/120 H.P., 145-H.P. motors, one 130-KW. transformer, controllers, resistances and switchgear.

Fife Coal Co., Leven.—Nineteen three-phase motors, 25/50 H.P. = 660-H.P., with controlling gear.

Aveling & Porter, Ltd., Rochester.—Eight three-phase motors, 2½/16 H.P. = 105½ H.P. with starting rheostats, wiring, &c.

London Corporation (for Central Criminal Court).—Eight 8-H.P. = 64-H.P. D.C. motors with starters and panels.

Gwynnes, Ltd.—Testing plant for the Borough of Hammersmith. One 120-KW. motor-generator set; one 110-K.V.A. type A.B.T. generator; one 146-H.P. motor; one 10-KW. exciter; one 140-KW. transformer and switchgear.

Grieves, Ltd., J. & T. M., Fort River Mills, Belfast.—Eight three-phase motors; 2/60 H.P. = 92 H.P. with switchgear.

Glenboig Union Fire Clay Co., Ltd., Glenboig, N.B.—Twenty three-phase motors; = 1,225-H.P., with controllers, resistances, panels, &c.

LIGHTING and POWER NOTES.

Acton.—The Council has received a letter from the secretary of the Metropolitan Electric Supply Co., in regard to the Council's proposal for the working of the local undertaking by the company. The company is prepared to entertain the proposal on the lines of a fair rental, the repayment to the company of capital expended less depreciation, the period of agreement to be such as would enable the company to earn a reasonable return on its capital, and the question of price reduction to be determined in accordance with commercial considerations. The company is unable to agree to the determining of the present agreement at the end of next year. The long debated question of gas or electric lighting at the new destructor has been left over for the present.

Barton-upon-Irwell.—The Lancashire Electric Power Co. has written to the R.D.C. offering to take over the E.L. Order, 1906, for the Clifton portion of the district. The Council has asked for further information.

Continental Note.—Spain.—The municipal authorities of Onate have secured a concession to put down a plant to utilise certain water power in the neighbourhood in the generation of electrical energy for lighting and power purposes.

Dover.—St. Margaret's.—A L.G.B. inquiry into the application of Dover T.C. for a loan to enable the E.L. mains to be extended to St. Margaret's-at-Cliff, was held on Friday. There was no opposition.

Dundee.—The T.C. has remitted back to the Committee the proposal of the electrical engineer and his committee that the department should have power to spend money on the construction of installations and the electric lighting of stairs and closes in the city, the owners to pay an annual sum to cover the interest on the capital expended in addition to the cost of the light.

Epsom.—A L.G.B. inquiry was held on Tuesday last week in regard to an application made by the U.C. for sanction to borrow £1,500 for the purposes of electric lighting. Mr. H. R. Hooper, M.Inst.C.E., held the inquiry, which was adjourned in order that more information required by the inspector upon certain points could be obtained

Gravesend.—A L.G.B. inquiry was held on the 18th inst. to inquire into the application for permission to borrow £6,000 in respect to the electric light system.

Limerick.—The city was in darkness for two hours on the evening of the 18th inst., the staff at the electric lighting station having struck owing to the reinstatement of an official who had been suspended.

London.—Hammersmith.—The Executive Committee of the Franco-British Exhibition deposited £1,000 with the B.C. in regard to the supply of electricity. Recently it asked that only £100 should be retained, the weekly bill being well within that figure. The B.C. has agreed to release £900.

Lyme Regis.—At a meeting of the T.C. last week a communication was received from Mr. Charles Balbiani, Mevagissey, with regard to a proposal to introduce electric lighting in the town, stating that he had been instructed by the promoters of the proposed Lyme Regis Electric Light and Power Co. to ask the Council to fix a day to meet him on the question, when he would lay before them the aims and objects of the scheme, together with the plans for the supply, and the buildings which had been secured as a generating station. It was unanimously decided that the Council should meet the engineer on the matter.

Macclesfield.—The General Purposes Committee of the T.C., on December 17th, discussed the proposal of the Macclesfield E.L. and Power Co. to apply for a prov. order for E.L., and it was decided to recommend the Council not to assent to the application, but that the Corporation should retain its own Order, under which at present nothing had been done.

Plymouth.—The Electricity Committee on Friday considered whether any means could be adopted to demonstrate the effectiveness of the electric light for street illumination, by the introduction of special arc lamps at prominent points in the centre of the town, and the electrical engineer was instructed to submit a report.

Somerset.—In the *Gazette* for December 18th there appears a notice of an application by the Somerset and District Electric Power Co., for power to amend its Act of 1903, to transfer provisional orders, &c.

West Bromwich.—Mr. R. G. Hetherington (L.G.B.), held an inquiry last week respecting an application by the Corporation to borrow £2,000 for electricity purposes. There was no opposition.

Worsley.—The U.D.C. has granted permission for the Lancashire Electric Power Co. to supply energy to Messrs. E. Lane and Sons.

TRAMWAY and RAILWAY NOTES.

Altrincham.—The U.D.C. intends leasing the tramways in the town to the Manchester T.C. for 23 years from May 10th, 1907. The rent reserved will be £843 2s. 11d. for the period between May 10th, 1907, and November 10th, 1908; £621 9s. for the period between the latter date and May 10th, 1909; and £1,181 8s. 2d. per annum afterwards.

Australia.—Victoria.—The Railway Commissioners, after considering Mr. Mers's report on the electrification of certain lines in and near Melbourne, have reported to the Premier condemning certain features of the scheme, and positively recommending that nothing further should be done at present towards electrifying the lines.

Birkenhead.—Plans of the first five sections of the projected electric railway between New Brighton and Birkenhead have been deposited with the local authorities, and it is stated that the contract will be given to Messrs. Hickman & Sons, contractors of New Brighton, who will also build the generating station in Victoria Road, New Brighton. It is locally stated that a Manchester syndicate is behind the project, and that in May an application is to be made for an inquiry by the Light Railways Commissioners.

Continental Note.—Austria-Hungary.—The present stir in electric railway engineering in the Dual Monarchy is evidenced by the fact that schemes for the electrification of both the Pressburg to Vienna and the Steyr to Linz railways are mooted. It is significant that these important towns, the two latter being the most considerable in the country after the capitals, should not have been provided with electric traction facilities ere this. Herr Scheinig, manager of the Linz-Urfahr Electric Tramway Co., is the leading spirit in the latter scheme, while the draft Bill for the former has already been laid before the Austrian parliament.

Foleshill.—Mr. J. Wilmer Ransome, of London, has informed the R.D.C. that he intends applying to the Light Railways Commissioners for powers to construct a light railway along the Coventry Road, from Nuneaton to Bedworth, a distance of three miles. The Council has referred Mr. Ransome to the Bedworth P.C. and Warwickshire C.C

Liverpool.—About midnight on Saturday last, a Liverpool Overhead Electric train, running into Seaforth terminus, got out of control, and collided with the buffers. Two coaches were smashed and twenty people injured. The accident is attributed to the greasy state of the track.

Llandudno.—At the monthly meeting of the Council a proposal to purchase the Great Orme Tramway was mentioned, the chairman reporting that, in reply to a request made by the Council, the company had furnished the clerk with details. He suggested that the letter be referred without being read to a special meeting of the Finance Committee. The suggestion was agreed to, and the electrical engineer was instructed to report on the working of the route by electricity.

London.—The District Railway authorities have decided to open free to the public the subway extending from South Kensington Station to the Albert Hall; hitherto a 1d. toll has been levied.

In January the 37-year-old arrangement by which the L. & N.-W. trains run over the District line from Earl's Court to the Mansion House will come to an end; the North-Western trains will in future run between Willesden and Earl's Court only, at 15-minute intervals. The withdrawal of these trains on the District will enable the latter company to further accelerate its service, and more frequent trains will be run on the Putney line.

L.C.C.—Sydenham and Forest Hill were brought into connection with the L.C.C. tramways system on Saturday last, when the recently constructed line from Lordship Lane to Forest Hill Railway station was brought into use.

A scheme for linking up and giving mutual running powers to the London United and L.C.C. tramways forms the subject of a Parliamentary Bill to be presented in the next session.

The Victoria-London Bridge section of the Brighton Railway, on which the installation of the single-phase system of traction has been leisurely proceeding for some time past, is stated to be practically complete. Experimental trains are to be run during the first week of January over the Battersea-Peckham section.

Some 25 miles of single track are being equipped, including seven tracks in the Victoria terminus and five tracks in the London Bridge terminus; repair shops are also being erected at Peckham Rye.

Middlesex.—It was reported at the meeting of the County Council on December 17th, that the Metropolitan Electric Tramways, Ltd., is negotiating with the L.C.C. for a continuance for a further period of the agreement under which the Spring Garden authority leased the short length of tramway from the Archway Tavern to Highgate Archway to the company. The Council approved of an arrangement under which the Herts C.C. Light Railways from the county boundary between Herts and Middlesex at Whetstone to the High Street, Chipping Barnet, and from the county boundary between Herts and Middlesex at Queen Eleanor Cross, Cheshunt, be treated as between the C.C. of Middlesex and the Metropolitan Electric Tramways, Ltd., as part of the County of Middlesex Light Railways under conditions. Objections are to be lodged against the Staines Electric Lighting Provisional Order, 1909, with a view to the insertion of clauses for the protection of the county interests. The county solicitor was instructed to lodge objections to the Edgware and Hampstead Railway Bill, 1909.

Oldham.—The Corporation has just deposited a Parliamentary Bill for next session, which authorises it to construct additional tramways, and confers further powers as to the electricity undertaking. The tramways proposed are over a mile and a half in length, and the Corporation intends to secure powers to run trackless vehicles, thus following the example of the Manchester Corporation. The Oldham Bill differs from the Manchester one in that it provides that the cars to be run on the system are not to weigh more than four tons unladen. Oldham also wishes to utilise motor-omnibuses where necessary, desiring to spend £7,200 on the experiment.

Perth.—It is proposed that a new tramway depôt should be erected in King Edward Street. At present a good deal of inconvenience is caused by the depôt being at Scone, at the extreme end of the system, and the cars having to travel there late at night.

Portsmouth.—Although the T.C. is running the electric cars on the inner circle route at a loss of £2,715 a year in wages alone, it has decided to continue the service through the winter, to avoid throwing out of work 21 motormen, 21 conductors and three car cleaners. These will be transferred to the Goldsmith Avenue route when that extension is completed, which will probably be next summer.

Sunbury.—At a meeting of the U.D.C. a communication was received from the London United Tramways Co., Ltd., notifying its intention to apply to Parliament to extend the time during which it could compulsorily purchase certain land necessary for the laying of proposed lines. The clerk intimated that as nothing had been done since 1904, the Council should object. After a discussion, the clerk was requested to inquire more fully as to the company's intentions.

Torquay.—Application is being made to the B. of T. for the transfer of the tramway undertaking from the Dolter Electric Traction, Ltd., to the Torquay Tramways Co., Ltd. The consideration is £157,500.

U.S.A.—New York.—So much dislocation of traffic on the street electric lines resulted from a fall of snow on Thursday last week, that even English methods of dealing with snowfalls were held up as examples to the local authorities.

TELEGRAPH and TELEPHONE NOTES.

New Zealand.—During 1907-8 the telegraphic system of New Zealand increased by 1,132 km. of line and 3,724 km. of wire to 15,401 km. of line and 47,244 km. of wire. Besides this, there were 651 km. of submarine cable. 167 new telegraph offices were opened during the year, and three were closed, making the total number of offices 1,611, of which 1,331 are in telephonic communication. The ordinary traffic shows a substantial increase over 1906-7. There were 6,958,279 private and Press telegrams and 84,644 Government messages, making a total for the year of 7,042,923 telegrams—an increase of 646,591 over the preceding year. Of the total, 452,536 were Press messages. Traffic exchanged over the Pacific Cable amounted to 77,537 ordinary and 477 Press telegrams to Australia and 24,953 ordinary and 38 Press messages to other countries. The figures for the Eastern Extension route were, to Australia, 10,711, and to other countries 4,258 telegrams. Dealing with traffic to New Zealand, 17,134 international telegrams were received *via* the Pacific Cable as well as 52,696 from Australia, while 11,020 were transmitted through the Eastern Extension from places outside Australia and 23,273 from Australia. These figures show that the Pacific cable is holding its own in a satisfactory manner. The revenue amounted to £227,398, or an increase over 1906-7 of £20,691; 73,763 telegraph money orders were sent during the year dealing with sums amounting to a total of £3,688; 389 private wires were in existence, against 351 in the year before, and £2,182 was received on this account. The report also mentions that inland, inter-Colonial and international messages sent to registered addresses not entered in the books have, nevertheless, been delivered. A new cipher code was introduced, whereby a great saving in the number of words on account of meteorological telegrams was effected. On January 1st last regulations came into operation permitting the delivery of telegrams by telephone. Payment for such service can be made by an annual subscription of £1 or 3d. for every three minutes.

The telephone system owned 1,672 km. of line and 29,972 km. of wire, this being an increase over the previous year of 147 km. of line and 5,500 km. of wire. There were 112 stations at March 31st, 1908. During 1906-7 there were altogether 17,403 subscribers, &c., and in the year under review the figure was 23,881, showing an increase of 6,478. Wellington had 3,781 subscribers; Auckland, 3,184; Christchurch, 2,978; and Dunedin, 2,713. Receipts amounted to £116,852, an increase of £16,039 over 1906-7. Expenses amounted to £357,581 for both the telegraph and telephone services, and this figure shows an increase of £66,221 over the previous year. The costs of construction and maintenance were £130,400 and £59,960 respectively. At March 31st, 1908, the capital value of both services was represented by £1,479,736. The loss on the year's working was £8,832. —*Journal Télégraphique.*

Norway.—According to the *Zeitschrift für Schwachstromtechnik*, a new use for the telephone has been devised in connection with the fisheries. A sensitive microphone is enclosed in a water-tight case formed of sheet steel, and lowered into the sea. Well insulated wires connect the microphone with the receiving station on board ship. It has been observed that each kind of fish exerts a different influence on the microphone, so that the fishermen on board are apprised not only of the approach of a shoal of fish, but also of the kind of fish composing it. We take no responsibility for these statements.

Penny Telegrams.—The Postmaster-General, replying in the Parliamentary papers to Mr. Summerbell, M.P., states that he is not prepared to adopt a suggestion of "penny post-telegrams," *i.e.*, telegrams sent over the wires to fall into the next delivery by postmen on reaching their destination, at, say, 10 words for 1d., and ½d. for each additional word.

Sweden.—The Government has taken a further step in popularising the telephone by reducing the charge for connections to 10 kr. (11s.), and the yearly subscription to 30 kr. (33s.). This entitles a subscriber to use the telephone 150 times during the quarter, and for every additional time a further charge of 5 öre is made. The new arrangement, which comes into force on April 1st next, is primarily intended for private individuals and those only infrequently making use of the telephone.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Port Arthur-Chifu	Mar. 9, 1904 ..	..
Pontianak-Saigon	Sept. 16, 1908 ..	..
Dakar-Conakry	Nov. 6, 1908 ..	Dec. 16, 1908

The Telewriter.—Last week the telewriter was "put through" from London to Manchester, and the respective Lord Mayors exchanged mutual greetings in their own handwriting over the telephone wires.

(*Continued on page* 1095.)

ELECTRICITY IN A BELGIAN STEEL WORKS.

The large steel works of the Société Anonyme des Aciéries d'Angleur, at Tilleur, possesses an installation of electricity for lighting and power, which exemplifies the flexibility and usefulness of that agent in a high degree. An account of it is given in the *Bulletin* of the Société Belge d'Electriciens, from which we extract the following particulars :—

Three years ago the works had an electric plant of some 375 kw., which served the cranes, capstans, &c., but most of the power required was provided by steam and hydraulic machinery ; the output was then 9,000 tons of Thomas steel per mensem. It was found necessary, however, to install new converters of larger capacity, capable of turning out 25,000 tons a month, and at the same time two large electric cranes were substituted for the steam locomotives and hydraulic crane previously employed, while the numerous small and scattered steam engines were removed to make way for electric motors. It was decided to obtain the necessary power supply from the company supplying the district with three-phase current at 6,300 volts, the old power station being converted into a sub-station, and the contract was placed with the Compagnie Internationale d'Electricité. The existing motors and the lighting were supplied at 120 volts D C., and this system was continued ; but for all new motors a supply of three-phase current at 500 volts was provided.

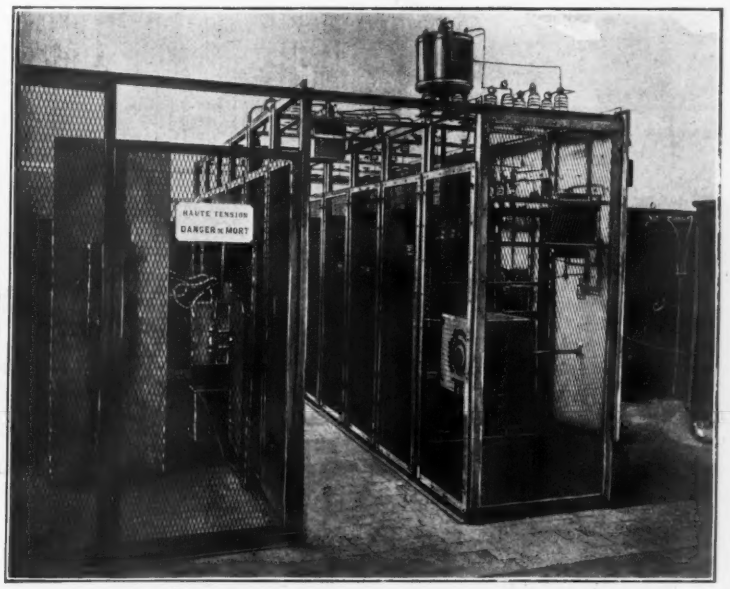


Fig. 1.—High-Pressure Switchgear.

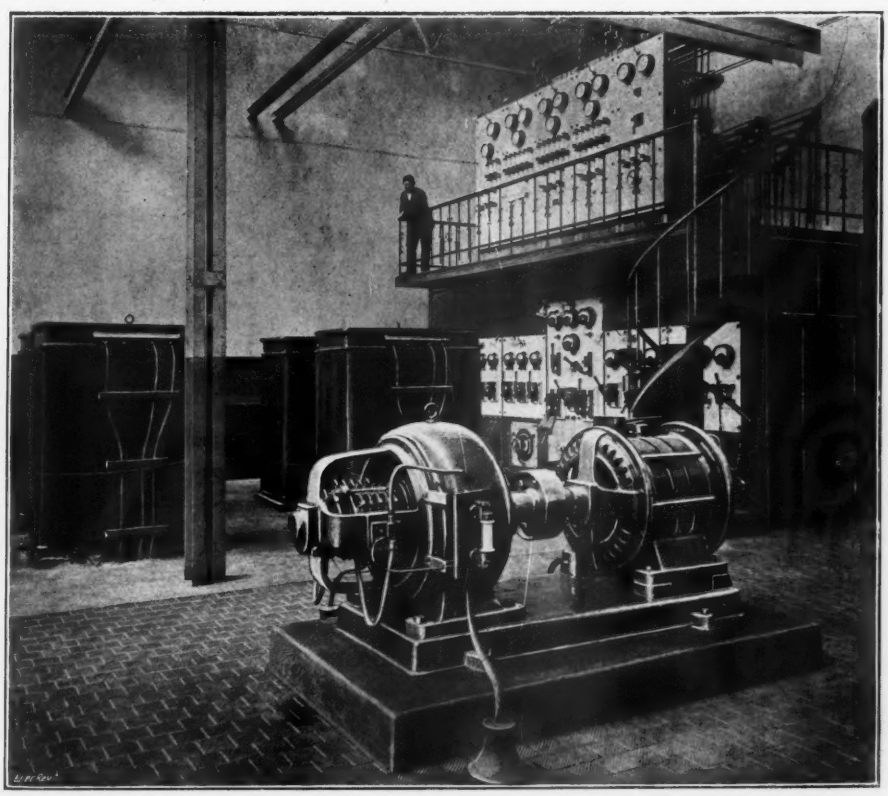


Fig. 2.—Low-Pressure Switchboards, and Motor-Generator.

The sub-station was fed through duplicate armoured feeders, brought into an enclosed compartment (fig. 1) containing section and earthing switches, instrument transformers, oil fuses and high-pressure busbars. The switchboard consists of six marble panels, provided with the necessary measuring and controlling apparatus for the incoming power, main transformers and a synchronous motor coupled to one of the old generators. Oil switches are used, and the instruments are all supplied at low pressure ; the high-pressure apparatus is enclosed by partitions of expanded metal, and each panel can be isolated by means of section switches. The low-pressure switchgear (fig. 2) is divided into two parts, the

lower being devoted to the D.C. supply at 120 volts and the upper to the three-phase 500-volt supply. From a distributing tower above the switchboard, the power is transmitted by overhead conductors to the various points where it is utilised.

The old D.C. generator, of 225 KW. output, is coupled to a synchronous motor supplied at 6,300 volts, 50 cycles, but the Westinghouse engine which formerly drove it has been

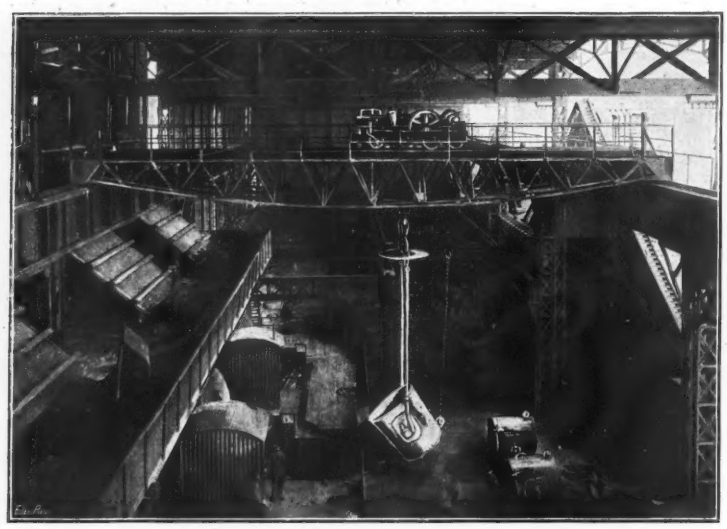


FIG. 3.—ELECTRIC TRAVELLING CRANE FOR LADLES.

left in position (fig. 5) and can be used to drive it in case of need, or to drive the A.C. motor as a generator, thus providing a very convenient stand-by. The A.C. motor further enables the power factor of the high-pressure supply to be improved. A small D.C. generator of 44 KW. output at 120 volts, seen in the foreground of fig. 5, is driven by an induction motor and serves both to start the large motor-generator and for lighting purposes. The other old steam set, of 150 KW. output, is held in reserve, or is used on Mondays to supply the D.C. circuits, the large cranes being but little used on that day in consequence of the stoppage of the steel plant. Four 200-KW. transformers in oil tanks provide for stepping down the high-pressure supply to 500 volts. The total power available is some 1,800 H.P. All the alterations were effected without interrupting the service. The boilers are still required to supply steam to the blowing engines. One result of the conversion to electric driving has been to reduce the cost of power from 1d. to 0·6d. per B.H.P.-hour, or 40 per cent. In addition to this, the enormous losses by condensation in the long and exposed steam pipes were done away with.

There are in all about 70 motors, averaging 20 H.P. each; these are fed from five distributing centres consisting of glazed cabins accessible only to the electrician in charge, and containing the necessary switchgear.

The existing machine tools, formerly driven by belt or by separate steam engines, have been made use of under the new *régime*; some examples are shown herewith. Fig. 6, p. 1093, shows a double punch and straightener, which has been converted by fixing a gear wheel to the inner face of one of the fly-wheels carried by the crankshaft, which was formerly driven direct by a steam engine; a three-phase slip-ring induction motor of 15 H.P., running at 1,000 R.P.M., is carried on a bracket bolted to the frame of the machine, and drives the spur-wheel through a pinion. In another case, one of the fly-wheels has been replaced by a disk carrying two concentric gears, one having external, the other internal teeth; the motor pinion can be brought into gear with either, so as to give two speeds to the punch.

On the right of fig. 7 is shown a milling machine for trimming the ends of rails and fish-plates, formerly driven by belt, and capable of being moved sideways on slides to suit the length of the work. The whole machine has been mounted on a bed-plate arranged to carry also the motor. The latter is of the squirrel-cage type, of 5 H.P., running at 1,000 R.P.M., and drives the machine with a raw-hide pinion through double-reduction gearing. Power is supplied by a flexible cable from overhead, the switchgear being fixed on the machine. On the left hand of the same view there is a double punch for fish-plates, formerly belt-driven. The pulley has been replaced by a spur-wheel driven by the motor pinion, double reduction being thus obtained. The motor is identical with that last described.

Fig. 8 shows a double straightening press, formerly belt-driven; a 15-H.P. motor running at 1,000 R.P.M., with slip rings, has been fixed on the top of the press, and drives one of the fly-wheels through a belt kept taut by means of the Lenix jockey-pulley device, which ensures adhesion of the belt in spite of the short centres. The switchgear in this case is mounted in a cage of expanded metal close at hand, and includes a rheostat. A series of milling machines is driven by a 23-H.P. motor, and a set of four quadruple

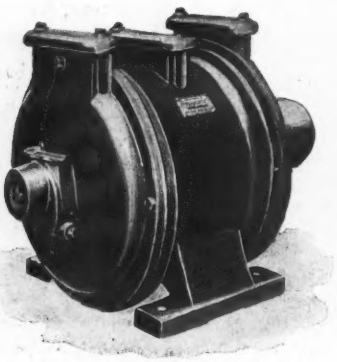


FIG. 4.—VENTILATED MOTOR.

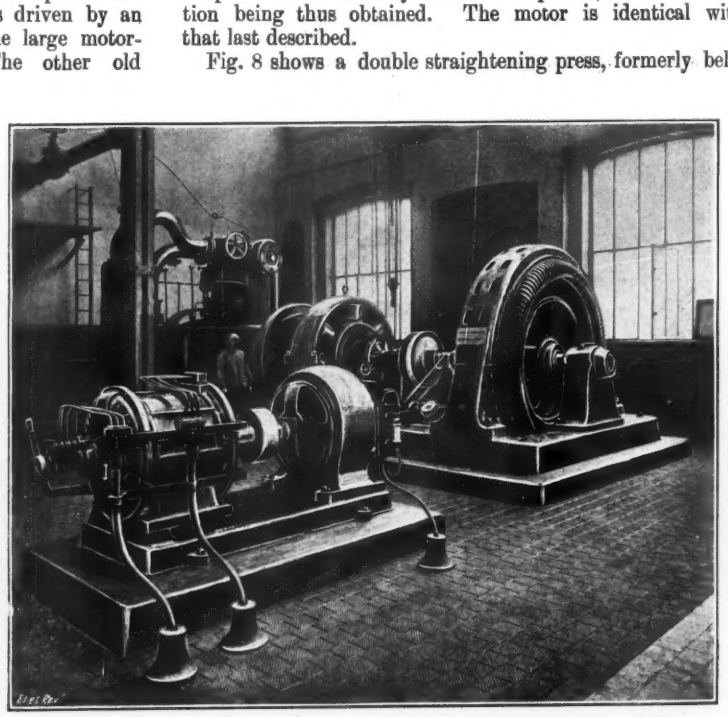


FIG. 5.—SYNCHRONOUS MOTOR-GENERATOR AND STARTING MOTOR-GENERATOR.

drilling machines, together with two quadruple milling machines, is driven by a motor of 40 H.P.

The presence of dust consisting largely of iron oxide in the works has rendered it necessary to mount the motors as high as possible above the ground, or to enclose them completely; a special motor devised by the Compagnie Internationale d'Electricité for this purpose is shown in fig. 4. It is provided with ventilating apertures below, and with chimneys above, which are covered with caps bolted on. The motors are blown through every week to clear out the dust.

The excellent results obtained from the first installation of electric motors, on the score both of economy and reliability, determined the company to adopt electric driving throughout their new machine shops.

A notable gain in speed of work has resulted from the use of electric motors. The steam engines formerly employed used continually to slow down when work was put into a machine, necessitating delay to enable the speed to rise again before the next operation took place; with motors, the speed remains constant, and the output has been increased.

Two advantages of electrical driving are especially appreciated: the absence of untidy oil and water leakages, and the facility with which the ampere-meter shows at any moment the state of the machine or tool which is driven.

Besides the examples given above, there is, of course, a large variety of applications of the electric motor in these works; lathes, planers, blowers, pumps, slag-breakers, &c., are all so driven. Electric cranes, elevators, capstans, &c., of various types are also in use. We illustrate in fig. 3 a traveller of 40 tons capacity, provided with an auxiliary lift for tilting the ladle; there are two of these large cranes, spanning 18 metres. The main hook lifts 40 tons at 2·5 m. per minute, and is arranged so as to lift the ladle directly from the truck on which it is brought from the blast furnace, carry it to the Thomas converters, and, by means of the auxiliary chain, which has a capacity of 5 tons at 4 m. per minute, pour the molten metal into the converter. The motors employed on the crab are of 40 H.P. each for the main lift and for travelling, and 11 H.P. for traversing. The ladles of metal weigh only 25 tons at most, but the full lift of 40 tons is necessary in order to remove the converters when repairs are required.

At a later date it is proposed to install gas engines fed with gas from the blast furnaces, driving generators to take the whole load, when a further economy will be secured.

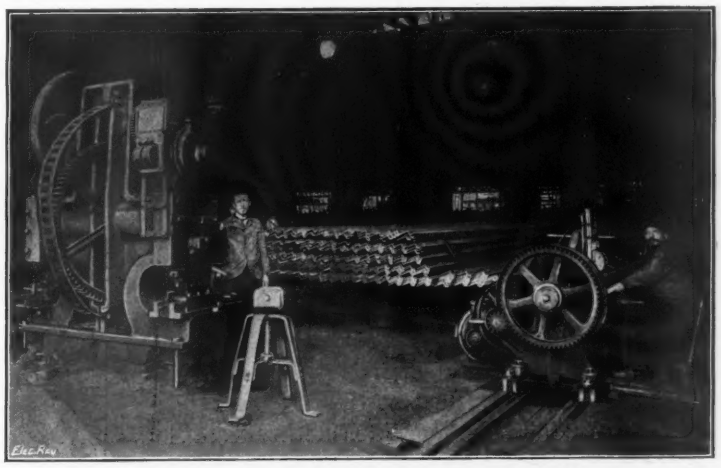


Fig. 7.—Milling Machine and Punch.

We are indebted to the Compagnie Internationale d'Electricité, of Liége, who installed the electrical plant, for the photographs from which our illustrations have been prepared.

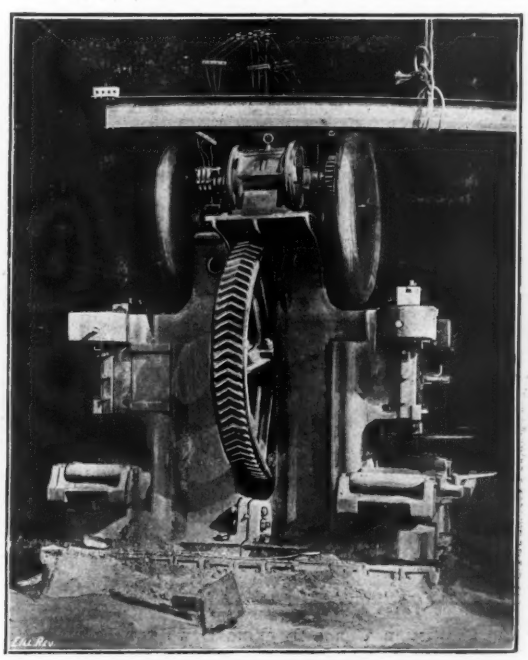


Fig. 6.—Double Punch and Straightening Press.

A NORWEGIAN HYDRO-ELECTRIC POWER SCHEME.

By F. HANDLEY PAGE.

There are a great number of industries, especially those involving electro-chemical processes, whose success depends upon obtaining a power supply at a very low cost. To the keen manufacturer, ever ready to reduce the first cost of his works, Norway with its large amount of available water-power has long appealed as a suitable country in which to

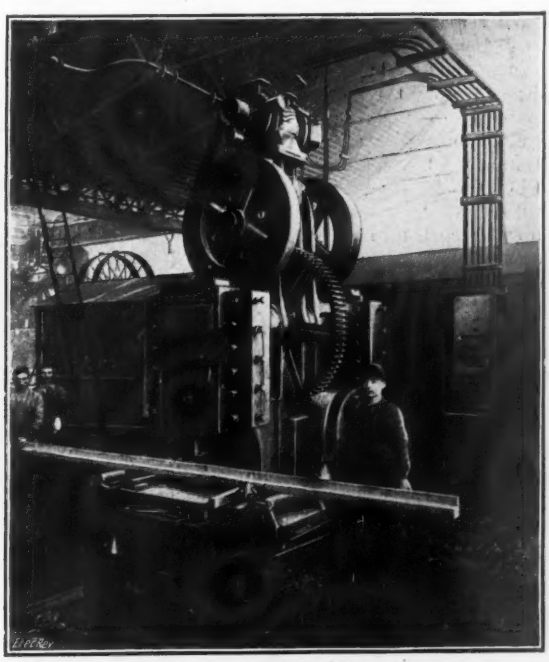
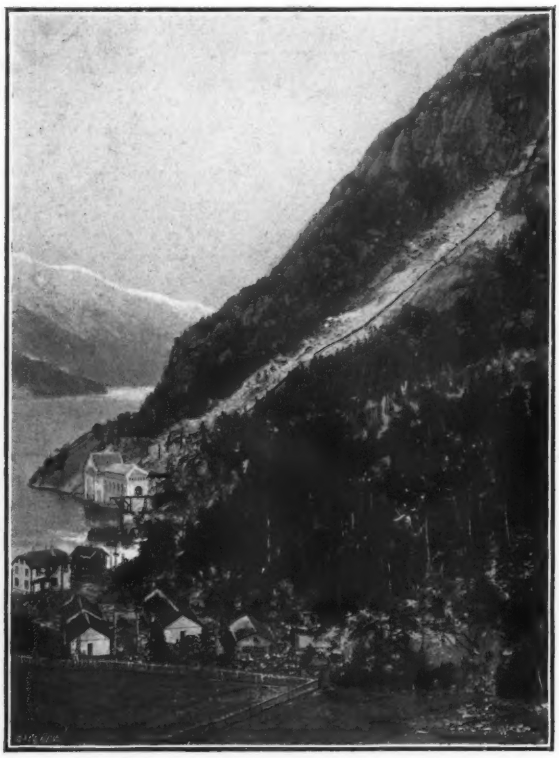


Fig. 8.—Double Straightening Press.

erect new works on account of the cheapness both of land and power. It is, however, often difficult to obtain suitable building sites close to the falls, so that water-power schemes have generally involved a transmission line, sometimes several miles in length. That this has been no bar to the success of such schemes is amply proved by the number of chemical factories which have been put up during the last few years.



View showing the Pipe Line, Power House, &c.

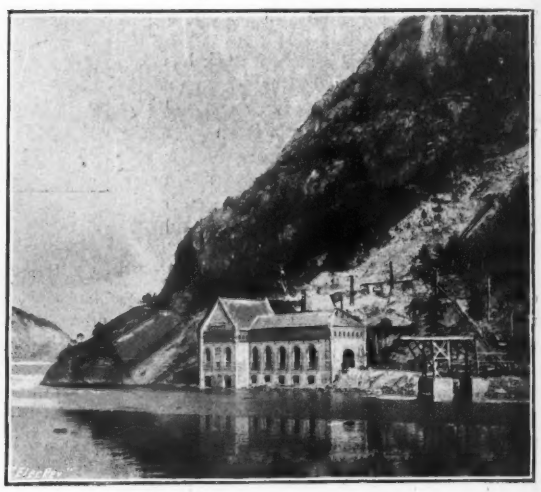
One of the latest chemical processes to be adopted on a commercial scale is that in which nitrogen is extracted from the air and fixed in manure. The manufacture was first started on an experimental scale in Italy, but the successful results obtained by agricultural experts aroused so keen a demand for this product — calcium cyanamide — that large works were erected in Odda, at the head of the Hardanger Fjord, capable of producing 12,000 tons a year. In conjunction with this factory a second works has been erected to supply the necessary carbide required as the raw material of the manure, and for the independent supply of carbide for lighting purposes.

The power house is situated about seven miles down the Fjord close to the water edge, and at present has a capacity of 20,000 H.P. The long pipe line stretching down the side of the cliff can be seen in our view; this connects with a tunnel three miles long, driven through the side of the hills, to the chain of lakes lying in the Tysse Valley, which are fed by several large falls deriving their water from permanent glaciers. The total head at the turbines is about 400 metres.

The power house was equipped throughout by the Allmanna Svenska Elektriska Aktiebolaget, who supplied both machines and switchboards.

The machines, of which there are eight, are each of 3,000 H.P. generating at 11,000 volts pressure, and running at 300 R.P.M. direct-coupled to Escher, Wyss turbines. The latter are fitted with the usual governing gear and also with a safety device, close by the intake, so that if there is a sudden rush of water or big rise in pressure, the bursting of the safety pipe allows a direct overflow to the outfall. There are one or two points in connection with the machines which are slightly different to the usual British practice; the poles of the revolving field instead of being bolted to the yoke ring are fixed by a large key fitting through an extension of the pole on the inner side of the ring. The coils, too, of the H.T. winding are completely bound round with tape making a smooth surface over both insulating trough and coils instead of the usual projecting micanite tube quite clear of the disks.

Excitation is obtained from two small direct-current sets, each set being of about 120 KW. capacity at 100 volts pressure.



A Near View of the Power House.

The switchboard is fixed at one side of the station, and is of the usual remote control type.

The overhead line is carried along the Fjord at the base of the cliffs; lattice girder poles are used where the span is long or special strength is required, and in other places ordinary wooden poles are used.

There are two sub-stations at the Cyanamide Works of the North-Western Cyanamide Co., Ltd., one for the motor and the other for the furnace supply. The motor sub-station contains Johnson & Phillips H.T. and L.T. switchgear and standard 600-KW. oil insulated water-cooled transformers. The latter are of the butt-joint type, with the core clamping plates so arranged that the trans-

The Carbide and Cyanamide Works, Looking Down the Fjord.

formers can easily be taken apart in case of a breakdown. The four wing nuts at the top of the core are unscrewed, and the yoke moved to one side, and the coils can then be easily removed. The high-tension winding is separated from the low-tension by porcelain insulators, and the oil has a free circulation between the high-tension and low-tension coils and between the coils and core.

The furnace room sub-station is also equipped with Johnson & Phillips switchgear and transformers. The latter are of a similar construction to those described above, and transform from 11,000 volts to the low pressure required for the electric furnace. Before putting the transformers into action the high-tension windings were all tested with 16,000 volts to earth, and also with the same pressure across the terminals to ensure that there were no short circuits. After 24 hours' full-load test at the works the temperature rise was about 30° C.

The actual process of cyanamide manufacture is as follows :—The carbide is conveyed by an aerial ropeway to the cyanamide works, where it is crushed in a series of three special mills to a fine powder. It is then filled into movable retorts, which are placed in the electric furnace and heated to some 1,000° C., nitrogen being forced in under pressure. As the result of continuous heating for several hours, cyanamide of lime is formed. This, after cooling, is conveyed to crushers, which reduce it to a fine powder. It is then stored in the silo ready for packing and delivering to customers as a 20 per cent. nitrogenous fertiliser.

The writer's thanks are due to the North-Western Cyanamide Co., and to Messrs. Johnson & Phillips, Ltd., for permission to publish the details given above.

TELEGRAPH and TELEPHONE NOTES.

(*Continued from page* 1090.)

Madrid.—A company styled the Compania Ibérica de Redes Telefonicas has been formed at Madrid, to construct and work urban and interurban telephone services. As the telephone has not yet penetrated into many parts of Spain, a useful career should be open to the company.

Municipal Telephones.—The manager of the Portsmouth Corporation Telephones has issued a circular, pointing out the advantages of the municipal system. He makes comparisons with Southampton, the nearest large town where there is no municipal service. In Portsmouth for a telephone and 1,000 calls £4 is charged; in Southampton a private resident has to pay £7 16s. 8d. and a business man £8 5s. Portsmouth and Hull are the only two towns in the country which have maintained the municipal system against the opposition of the National Telephone Co. and the Post Office.

CONTRACTS OPEN and CLOSED.

OPEN.

Algeria.—January 15th. Tenders are invited by the Bône municipal authorities for—(1) the construction and working of a central electric power station, and (2) the construction and working of an electric tramway. Copies of the projects, specifications, &c. (in French), may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Australia.—Sydney, N.S.W.—April 28th, 1909. The Postmaster-General requires tenders for the supply, erection, &c., of a branching metallic multiple magneto switchboard at the William Street telephone exchange, according to specification No. 236. Specification may be seen at the Electrical Review Office. Also see our "Official Notices" December 18th.

Sydney.—February 22nd. Five water-tube boilers, economisers, stokers, feed pumps, pipework, &c., for the Council's electricity department. See "Official Notices" December 11th.

Austria.—Trieste.—January 5th. The San Andrea dock authorities require tenders for 12 movable electric cranes. The Technische Abtheilung der Lagerhausverwaltung will deliver specifications at cost price.

Beckenham.—January 4th. Electricity meters for the U.D.C. See "Official Notices" December 18th.

Belgium.—Brussels.—January 8th. The Palais de Cinquantenaire electric lighting installation is to be adjudicated on January 8th, 1909; a deposit of £18 is required. Specification No. 89 may be obtained for 3d. and plans for 4s. 2d., at 15, Rue des Augustins.

Birmingham.—December 29th. Electric motors for the Corporation Electricity Supply Department. See "Official Notices" December 4th.

Douglas (Isle of Man).—December 31st. Tramway stores for the T.C. for a year. S. Robinson, Tramway Offices, Strathallan Crescent, Douglas.

Fareham.—January 20th. Three alternators and exciters, high and low-pressure switchboards, overhead travelling crane, for the Council. See "Official Notices" December 18th.

Germany.—The municipal authorities of Wandsbek are at present inviting tenders for the establishment of an electric lighting station in the town, at an estimated cost of £50,000.

Tenders are about to be invited by the municipal authorities of Biebermuhle (Palatinat) for the establishment of a central electric lighting station in the town.

Hungary.—The municipal authorities of Szarvas are at present inviting tenders for the establishment of a central electric lighting station in the town.

Italy.—Rome.—February 8th. Tenders are required for the lighting of the Palais de Justice, including fittings. Inquiry must be made, through local agent, at the chief engineer's office for the General Service of Rome, Department of Public Instruction.

Leith.—January 6th. One 600-kw. steam dynamo for the Corporation electricity department. See "Official Notices" December 18th.

Middlesbrough.—December 30th. Twenty flame arc lamps, posts, &c., for street lighting. See "Official Notices" December 18th.

Portsmouth.—January 4th. Materials for Corporation tramways construction. See "Official Notices" December 18th.

Powick (near Worcester).—Producer gas installation at the Asylum for Worcestershire County Council (£1,850).

Russia.—Baku.—January 24th. The T.C. is inviting tenders for its electric tramway concession (42 years). Full particulars at the Russian Consulate in London.

Spain.—December 30th. The municipal authorities of Castro del Rio invite tenders for a concession for electric lighting during a period of 20 years, on the basis of an annual rent of about £214. Tenders must be accompanied by a provisional deposit of £214, to be increased to about £428 by the successful tenderer.—*Board of Trade Journal.*

CLOSED.

Bolton.—The Education Committee has accepted the tender of the Corporation electricity department for installing the electric light and a fan at Tonge Moor Schools.

Croydon.—The Corporation has accepted the tender of Messrs. W. J. Bishop & Co., Croydon, at £59, for wiring and fitting at the department's inquiry office and store (3, Park Lane). The maintenance contract with the Tudor Accumulator Co. for one battery has lapsed, and the contract for the second would lapse in the spring. The amount paid per annum for the two batteries was £58. It was resolved to extend the contract for five years at the increased rate of £65 per annum.

Finchley.—Messrs. Francis Reade & Co., a local firm, have received the contract for lighting, bells and intercommunication telephones for a new house in Hendon Lane, Finchley, for Mr. G. Monro, Jun.

London.—Marylebone.—The B.C. received tenders for the supply of paper-insulated, lead-covered and armoured cable from the following firms, viz, Aubert, Grenier & Co., Union Cable Co., Siemens Bros., Western Electric Co., Johnson & Phillips, St. Helens Cable Co., Callender's Cable Co., W. T. Glover and Co., Blackwell & Co., Henley's Telegraph Works Co., British Insulated & Helsby Cables, Ltd., and Lahmeyer Electric Co. It was explained that tenders from foreign firms had been invited owing to a combination among British firms to keep up prices. About

one-third of the cable is required in connection with the new street lighting, the remainder being for the ordinary requirements of the undertaking. Upon the recommendation of the Electric Supply Committee, the Council accepted the lowest prices in the tenders of Messrs. Aubert, Grenier & Co. and the Union Cable Co., subject to the samples proving up to specification standard, these prices amounting to £500 less than the lowest prices of the British firms. The detailed prices per 220 yards of the successful firms were as follows:—

Union Cable Co.—s.w.a. single, 7/18 £4 5s. 4d.; 7/16 £7 5s. 3d.; twin, 3/20 £7 11s.; armoured, 7/20, five-core, £18 6s. 9d.; ·050 sq. in. concentric £26 5s. 1d.; triple-concentric, ·025 by ·025 by ·025 £27 17s. 10d.; ·050 by ·050 by ·035 £37 19s. 6d.; ·4 by ·4 by ·15 £162 15s. 7d.; ·5 by ·5 concentric £149 13s. 10d.

Aubert, Grenier & Co.—s.w.a., 7/20, five-core, £13 12s. 5·8d.; concentric, ·025 sq. in. £10 9s. 2d.; ·050 sq. in. £21 3s. 8d.; ·5 by ·5 £135 18s. 6d.; triple-concentric, ·025 by ·025 by ·025 £20 12s. 8d.; ·050 by ·050 by ·050 £30 5s. 10d.; ·1 by ·1 by ·05 £46 5s. 6d.; ·15 by ·15 by ·075 £64 4s. 10d.; ·25 by ·25 by ·125 £94 2s.; ·4 by ·4 by ·15 £142 2s.; 1 sq. in. single £131 15s. 6d.; armoured, 7/20, five-core, £17 3s. 2d.; triple-concentric, ·1 by ·1 by ·05 £57 5s. 6d.; ·15 by ·15 by 075 £76 4s. 10d.; ·25 by ·25 by ·125 £108 2s.; 1 sq. in. single £144 15s. 6d.

The Council also received tenders for the supply of ducts, troughing and bridges from the following firms, viz, D. F. Thompson & Co., R. W. Blackwell & Co., Key Engineering Co., Doulton & Co., Howard Asphalt Co., C. G. Warne, Albion Clay Co., and Sutton & Co. The articles are mostly required in connection with the service to Messrs. Selfridge & Co.'s new premises. The tenders of the Albion Clay Co., Ltd., and Messrs. Sutton & Co., being the lowest, were accepted.

CHELSEA.—The B.C. has accepted the tender of Messrs. Wright Bros. & Co., at £23 17s. 6d., for putting the electrical installation in the old portion of the Town Hall into repair. It has further accepted the tender, at £35 7s. 6d., of the same firm for carrying out work on the electrical installation in the new portion of the Town Hall.

Aldershot.—The U.D.C. has accepted the tender of Messrs. Heenan & Froude for additional plant at the refuse destructor at £753. Messrs. Meldrum Bros. tendered at £774, and Messrs. Hughes and Stirling at £760.

Worksop.—The U.D.C. has accepted the tender of the Mordey-Fricker Electricity Meter Co., Ltd., for 50 slot meters at £2 3s. 9d. each.

Bedford.—The Education Committee has accepted the tender of Mr. J. Source, 28, Tavistock Street, for electrical supplies for six months.

Bradford.—The Education Committee has recommended the City Council to accept the tender of the Bradford Electrical Engineering Co., Ltd., for the installation of electric light at the Green Lane Child Feeding Centre, for the sum of £97 10s.

Cape Town.—The tender of the Clyde Engineering Works has been accepted for the wiring of the new premises in Cape Town forming the head office of the Bank of Africa, Ltd. The amount of the tender is £1,543, and includes electric light wiring, and supply and fixing of fittings, central battery intercommunication telephones, bells and fire and burglar alarms. The consulting engineer is Mr. W. C. P. MacMuldrow.

The tender of Messrs. Reunert & Lenz, in conjunction with the Clyde Engineering Works, has been accepted for the supply and erection of additional steam raising plant at the Cape Town Corporation Electric Light Works. The work comprises Babcock and Wilcox boilers, Green's economisers, &c.

CONTRACTORS' COLUMN.

The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERDEEN.—Proposed covered-in Produce Market in Exchequer Row; City Architect, Aberdeen. Proposed factory in Seaforth Road, for Sang & Co., aerated water manufacturers; Secretary of the company. Improvements at University Bar, Old Torry (£400); City Architect, Aberdeen. New drill hall, at Bucksburn; Secretary, Territorial Association, Aberdeen. Houses, Broomhill Road, C. Stephen, architect; University Road, H. Mennie, architect, 211, Union Street, Aberdeen; Camperdown Road, D. Hodge, architect, 20, Bonderond Street, Aberdeen. Houses in new street off Whitehall Place; Sutherland & George, architects, 26, Crown Street, Aberdeen. Proposed new church to replace John Knox Church; Rev. G. A. Johnston, minister.

ABERYSTWYTH.—Proposed rebuilding, after fire, of foundry, for Wm. Green, engineer, Aberystwyth. Proposed extension of Council schools; W. Dickens-Lewis, architect, Aberystwyth.

ARBROATH.—New railway station, Keptie Street (£50,000). Manager, North British Railway Co.

ATTLEBOROUGH.—Primitive Methodist church at Scoulton.

BAKEWELL.—Baths and pump room (£3,000). Bryden & Walton, architects, 1, George Street, Buxton.

BARNET.—Extension of girls' grammar school (£4,300). J. Ladds, architect, 98, Pemberton Road, Harringay, N.; Clark & Sons, builders, Godesdone Road, Cambridge.

BARROWFORD (near NELSON).—New dye works, for Virgil Whitehead.

BARTON-UPON-IRWELL (LANCS.).—Extensive works, Trafford Park, for the British Insulating Steel and Wire Works Co.

BEXHILL.—Additions to Devonshire House, Hastings Road; A. J. Sansom, owner; G. H. Gray, architect, 21, Sea Road, Bexhill. Detached house, Sutherland Avenue; F. G. Miller, owner; C. W. Spencer, architect. Detached house, Broad Oak Lane; G. H. Gray, architect. Gymnasium, Ancaster House, Dorset Road; Mrs. Burrows, owner; A. W. Jeffery & Son, architects. Alterations and additions to St. Wilfrid's School, Collington Lane; A. E. Clark, owner; P. Morley Horder, architect, 148, New Bond Street, London, W.

BISHOP AUCKLAND.—Alterations and additions to the Workhouse. F. H. Livesay, architect, Newgate Street, Bishop Auckland.

BLACKPOOL.—New premises at South Shore, for T. Carter, chemist.

BROADSTAIRS.—Houses, Lindenthorpe Road, for R. M. Ruck; Edge End Road, for A. L. Plowman.

CARDIFF.—New County Hall at Cathays Park (£45,000); E. V. Harris and T. A. Moodie, architects, 8, New Square, Lincoln's Inn, London, W.C. Intermediate boys' school (£12,000); Teather & Wilson, architects, Andrews' Buildings, Cardiff.

CASTLE DONINGTON (LEICESTER).—County School. W. Brand, architect, 33, Bowling Green Street, Leicester.

CHISLEHURST.—Enlargement of Council Chambers. W. J. Winter, surveyor to Urban District Council.

CORK.—Roman Catholic Church, presbytery, and schools.

COVENTRY.—Houses, Blythe Road, Jesmond Road, and Adderley Street for E. Harris; Westwood Road, for S. G. Baker; motor garage, Park Road, for Mrs. Joseph; additions to the Golden Lion Inn, Castle Street, for Marston, Thompson, & Evershed, Ltd.

CWMFELINFACH (MON.).—Seventeen houses, Maindee Road, for the Pioneer Building Club. J. W. Aldiss, architect, Newbridge (Mon.).

DENTON.—Houses, St. John's Road, Booth Street, and Charles Street, for R. Rippingham; Katherine Street and Elizabeth Street, for Chas. Rippingham; Law Street, for J. B. Catlow.

DUNDEE.—Villas in Muirfield Street, for J. K. Anderson. Alterations to Brown Street School; Mr. Langlands, architect to the School Board. Additions to warehouse, King Street, for East Port Works Co. Warehouse, Robertson St., for Halley & Sons.

TAYPORT.—House, Elizabeth Street, for A. Robertson; motor garage, William Street, for W. M. Pillans.

DUNFERMLINE.—Twelve houses at High Beveridgewell, for T. Condie; three houses and shop at Kingseat, for P. Hunter, mining contractor, Kingseat.

DUNSTON (near GATESHEAD).—New club premises. White & Stephenson, architects, 59, Grey Street, Newcastle-on-Tyne.

EDINBURGH.—New district Police Station in McLeod Street, Superintendent of Works, Edinburgh; hall for Edinburgh Marine Gardens Co., Mr. Ramsay, architect.

EASTLEIGH (HANTS).—New Church (£8,000); additions to residence, Oakbank, Bishopstoke, H. White, solicitor, Eastleigh.

ERDINGTON.—Important sewerage works for the U.D.C. (£7,200).

FARNHAM.—Church room (£3,500) on site given by G. F. Roumieu.

GLASGOW.—Development of Cardonald Estate; A. B. M'Donald, engineer, Glasgow Corporation. Proposed library in Queen's Park, for the Langside district.

GOLCAR.—House, Station Road. Arthur Shaw, architect, Golcar.

GRANGEMOUTH.—Proposed new Established Church.

GUILDFORD.—Proposed new chapel at the workhouse (£2,500). E. L. Lunn, architect to the Board of Guardians.

HARPENDEN.—Sanatorium for consumptive children; National Children's Home and Orphanage. Sewerage scheme for the U.D.C. (£31,500).

HEOLYCIN (GLAM.).—New school. T. Mansel Franklin, clerk to the Glamorgan C.C., Cardiff.

HERNE BAY.—Bungalow, Western Esplanade, for C. H. Lewis; J. Huxtable, architect, Station Road. Bungalow, Western Esplanade; R. Messenger, architect, 16, High Street. Four houses, Blacksole Road, for Miss E. Holness; R. Alaway, architect. Motor garage, Fleetwood Avenue, for R. N. Cattle; H. Pettman, architect, 15, High Street.

HIGH WYCOMBE.—Houses, London Road, for E. Taylor; Roberts Road, for A. Barnes; alterations to the Railway Commercial Hotel, Amersham Hill, for Mr. Johns.

ILKESTON.—Proposed enlargement of the Parish Church; Rev. C. M. Williams, vicar.

KILMARNOCK.—Repairs to Riccarton Presbyterian Church, and new hall. Rev. D. J. Tweedie, minister.

LEVEN (FIFE.).—Lodging house in Bridge Street, for Jas. Neaves, merchant.

LINDLEY (YORKS.).—Nine houses, Oakes Road. J. Berry, architect, Market Place, Huddersfield.

LITTLE HULTON (near BOLTON).—Central premises, junction of Clegg's Place and Manchester Road, for the Little Hulton Industrial Co-operative Society, Ltd. J. T. Proffitt, architect, 9, Longley Road, Walkden, Manchester.

LIVERPOOL.—New dental hospital, corner of Pembroke Place and Boundary Place (£10,000). L. S. Cohen, chairman of the Dental Hospital, Mount Pleasant, Liverpool.

LONDON (HACKNEY, N.E.).—Eleven houses, Holmbury View, Upper Clapton; F. Collins, builder, Springfield House, Upper Clapton. Eighteen houses, Ravensdale Road; P. Roche, builder, 127, Springbank Road, Hither Green, S.E. Additions to warehouse at rear of 9 and 11, London Lane, Mare Street; N. Fortescue & Sons, Ltd., contractors, 215, Mare Street, Hackney. Assembly hall, Stanborough Yard, rear of High Street, Kingsland. G. E. Wallis & Sons, Ltd., builders, West Street, Bethnal Green.

(FLEET STREET, E.C.).—Rebuilding Bell's Buildings (£21,800). F. W. Foster, architect, 41, Bedford Road, W.C.; F. G. Minter, builder, High Street, Putney.

(VAUXHALL, S.W.).—Enlargement of fire station. Spencer, Santo and Co., Ltd., builders, Earl Street, Westminster.

(TOTTENHAM, N.).—Warehouse and showrooms, Seven Sisters' Corner; P. Hart, builder, 99, Maynard Street, Walthamstow, N.E. Factory at Millington's Factory, Crown Works, Ryde Road; S. C. Tee, architect, 50, Moorgate Street, E.C.

(HENDON, N.W.).—New Parish Hall, Bremerton Road; Wills and Anderson, architects, 4 and 5, Adam Street, Adelphi, W.C. Block of flats for the Hampstead Garden Suburb, 32, Theobald's Road, E.C.

(HACKNEY, N.E.).—Iron building at Hackney Marsh. R. Harding and Son, builders, 75, Arodene Road, Brixton, S.W.

(BATTERSEA, S.W.).—Shop, 253, Battersea Park Road, for B. Brangrove.

(GREENWICH, S.E.).—Four houses in Maze Hill, Greenwich. N Drake.

(HORNSEY RISE, N.).—Adaptation of three houses for receiving home. E. Davey, clerk, Islington Guardians, St. John's Road, Upper Holloway, N.

(CATFORD, S.E.).—Adaptation of tramway depôt, Rushey Green, for business purposes. Norfolk & Prior, 4, Station Buildings, Catford Road, S.E.

(WHITECHAPEL, E.).—Buildings on site of 80, 81 and 82, Chamber Street. J. Hamilton & Son, architects, 23, Wormwood Street, E.C.

(LEWISHAM, S.E.).—Buildings on site of Nos. 169 to 173, George Lane, for F. E. Wright

LONDON (Norwood, S.E.).—Buildings in Curnick's Lane, Chapel Road. T. Martin, 46, Dalkeith Road, West Dulwich, S.E.

(N.).—Additions at 42, Woodberry Down, Finsbury Park, for H. Caslon.

(Hampstead, N.W.).—House, corner of Ardwick and Olive Roads. A. O. Breeds, architect, 62, Lincoln's Inn Fields, W.C.

(Deptford).—Rebuilding Joiners' Arms Public House, Church Street; Wylson & Long, architects, 16, King William Street, E.C.

(Bermondsey, S.E.).—Store, rear of 22, Rotherhithe Street, for A. Groom.

(Clapham, S.W.).—Lodge room, hall, &c., Wirtemberg Street. Blaxill Bros., builders, 122, Stanstead Road, Catford, S.E.

(Putney, S.W.).—Four houses, Langside Avenue. H. J. Hawkins, builders, 381, Upper Richmond Road, Putney, S.W. Billiard room at the Laurels, 372, Upper Richmond Road, by Maxwell and Co. Soup kitchen, Charlwood Road; E. Tribe, builder, 4, Deodar Road, Putney, S.W.

(Streatham, S.W.).—Photographic studio, High Road. A. J. & C. Hocking, builders, 56, Great Queen Street, W.C.

(Woolwich, S.E.).—Renovation of Herbert Road United Methodist Church. Rev. G. Corin, minister.

(Bloomsbury Square, W.C.).—Alterations to laboratories (£647). G. A. Lansdown, architect, 9, Regent Street, S.W.; Parkinson and Sons, builders, Fisher Street, Holborn, W.C.

LOWESTOFT.—Warehouse, Gordon Road, for Lowestoft Co-operative Society.

MAESTEG.—Mixed school at Tyderwen (300 children). T. Mansel Franklin, clerk to the C.C., Cardiff.

MAIDSTONE.—Bungalow, Heathfield Road, for John Arkcoll; two houses, Salisbury Road, for W. T. Burrows, builder, 27, Hedley Street; four houses, Church Road, Tovil, for N. L. Smith.

MARSDEN (Yorks.).—Proposed public baths. Urban District Council.

MORPETH.—School (520 scholars) for Northumberland C.C. C. Williams, secretary to the Education Committee, The Moot Hall, Newcastle-on-Tyne.

NORWICH.—New offices for Guardians. Morgan & Buckingham, architects, Upper King Street, Norwich.

OSWALDTWISTLE.—Ten houses, Margaret Street, for A. Woodworth; houses and shops, Blackburn Road, for Mrs. Taylor.

PAISLEY.—Proposed additions to sanatorium in Craw Road, for the Parish Council; copper and sheet-iron works in M'Gowan Street, for A. & J. Bodys, coppersmiths, Back Sneddon; alterations to shop, 15, Wellmeadow, for E. F. Ross.

PENNYCROSS.—Church, Weston Peverell. W. D. Caröe, architect, 3, Great College Street, S.W.

PETERBOROUGH.—Extension and improvement of Deacon's School, in Milton Street; the Governors. New West Town School; Town Council.

PLYMOUTH.—Store for Octagon Brewery Co., Martin Street. Additional stables, for the Great Western Railway Co. Store and stables; F. W. Parkhouse, Shute Park House, Glanville Street. Large shop extension, for J. Yeo & Co., draper, Bedford Street. Extension of motor garage, for J. H. Andrew & Co., motor engineers, Athenæum Place. Detached villa; W. Hearder, Union Street. Detached villa; R. C. Davy, 50, Alexander Road. Proposed Turkish and swimming baths; T. F. Upsher, 65, Westwell Street.

PORT TALBOT.—Enlargement of Eastern Council School. T. Mansel Franklin, clerk to the C.C., Cardiff.

PONTYCLUN (Glam.).—Infants' schools at Brynna and Llanharan; T. Mansel Franklin, clerk to the C.C., Cardiff.

PORTSMOUTH.—Stores in Milton Road; Bailey & White, contractors, 451, Commercial Road. Bakehouse, 46, Cromwell Road, Eastney; J. D. Knight.

RAMSGATE.—House, Ellington; Grummant Bros., builders, Grange Road.

READING.—Shops in Christchurch Road; O. Phillips & Son, builders, 27, Marlborough Avenue, Reading. Wesleyan Methodist Church on Caversham Heights.

RENFREW.—New police buildings (£5,000).

REYNOLDSTON (Glam.).—New school at Llanrhidian. T. Mansel Franklin, clerk to the C.C., Cardiff.

ROTHWELL (Northants).—Rebuilding premises in Bridge Street, for the Co-operative Society. H. Cayley, architect, Bank Chambers, Rothwell.

RUSHDEN (Northants).—New factory in Spencer Road, for Sanders and Sanders. H. Adnitt, architect; W. Packwood, builder, Rushden.

ST. MARY HILL (Glam.).—New school. T. Mansel Franklin, clerk to the Glamorgan C.C., Cardiff.

SAFFRON WALDEN.—Proposed baths for the T.C. (£1,150).

SHEFFIELD.—Extension of Union Offices. H. J. Potter, supervising architect, 24, Norfolk Row, Sheffield.

SHREWSBURY.—Extensive alterations to premises, High Street, for Henry Wells, jeweller.

SLAITHWAITE (Yorks.).—Houses, near the Cemetery, for Mrs. Herbert Bainforth and W. Mellor; Hill Top, for Edward Sykes; warehouse, Bridge Street Mill, for Pogson & Co.

SLEAFORD.—Proposed bacon factory, Grantham Road, for a local syndicate.

SOUTHAMPTON.—Proposed conversion of the Royal Pier pavilion into skating rink; Additions and alterations to School of Art, Havelock Terrace; W. A. Fussell. New church and schools at Hythe.

SOUTHEND-ON-SEA.—Houses, Inverness Drive, for J. Burrill; Brightwell Avenue, for J. T. Overall; Westborough Road, for A. W. Tibbett; Crossville Road, for T. Starden; Westborough Road, for C. H. Jerrard; alterations and additions to Westward Ho! Hotel, for Mrs. L. Hocker; house, shop, and stables, West Road, for J. G. Dinn; alterations, &c., Hotel Victoria, for E. A. Broadhurst; house, shop and stables, Westborough Road, for W. Hawkins; alterations and additions, Hotel Clieveden, The Cliffs, for Max Gruber; houses, Brightwell Avenue, for R. Kibbey; Inverness Drive, for J. Burrill; Lansdowne Avenue, for Geo. Bennett; Drake Road, for J. Atkinson; King's Road, Crowstone Road, for J. C. Gaillard; San Remo Parade, for W. Stubbs; Eastbourne Grove, for A. Morley; Westcliff Park Drive, for J. W. Davies; Highcliff Drive, for J. J. Blanch; Cranley Road, for R. Myall; Grand Parade, for E. Davey, builder, Elmer Avenue; Whitefriars Crescent, for A. S. Bailey; Sunningdale Avenue, for Chas. May; Highcliff Drive, for F. S. Oram; Somerville Gardens, for H. Walton.

STAINES.—Isolation Hospital. Secretary to Staines Joint Hospital District, care of Clerk to Staines Rural District Council.

STAINLAND (Yorks.).—Nine houses. Chas. F. L. Horsfall & Son, architects, Lord Street Chambers, Halifax.

STONEY CROSS (North Devon).—New Wesleyan Methodist Church (£800); site given by G. H. Lyle, Alverdiscott.

SUTTON (Essex).—New school. F. Whitmore, architect, 73, Duke Street, Chelmsford.

SWINTON (Lancs.).—Houses, Blantyre Street, for W. Farnworth. Houghton Lane, for F. W. Ross.

SWANSEA.—Five houses, Langland Road and Waterloo Place; Richard Lacey, builder, Francis Street, Swansea. Twelve houses, Middle Road, Cwmbwrla; J. & F. Weaver, builders, Manselton Steam Joinery Works, Swansea. Four houses, Bernard Street; J. and D. Jones, builders, Eaton Grove, Swansea. New offices, Carmarthen Road, for the Cwmfelin Steel and Tinplate Co., Ltd.; additions to factory and warehouse, Frances Street, for W. E. Fuller & Co. Infants' school, Brynmill (400 places) and school at Glanmor (1,200 places); also manual centres at Terrace Road school and Danygraig and Dyfatty schools; G. E. T. Laurence, architect, care of town clerk, Swansea Town Council. Gymnasium, cookery class room, &c., for higher girls' school; A. W. Halden, secretary, Swansea Education Committee. Asylum: R. H. Wyrill, engineer, Swansea Town Council. Alterations Midland Café, Wind Street, for R. E. Jones, Ltd.; rebuilding Masonic Hall, Caer Street.

TEDDINGTON.—Fifteen houses, Arlington Road, for T. J. Messum. Twenty-five houses, Winchenden Road; G. A. Gale, builder, 430, Fulham Road, S.W.

THORNE (near Doncaster).—Alterations and additions to schools for the West Riding of Yorks C.C. J. Vickers-Edwards, county architect, Wakefield.

TOTNES (Devon).—Addition to the Market Hall. Surveyor to the T.C.

TRURO.—Museum buildings. S. Hill, architect, Green Lane, Redruth, Cornwall.

TUNSTALL.—New infants' school in connection with St. Mary's Church. Rev. G. C. de Renzi, vicar.

UCKFIELD (Sussex).—Alterations and improvements at the Sheffield Arms Hotel, Fletching, for the Southdown and East Grinstead Breweries. W. Bussey, architect, Lewes.

UXBRIDGE.—Factory at Cowley, for F. Parker & Sons, 20, Newman Street, E.C.

WATFORD.—New office, Market Street, for W. King; new lock-up shop, Aldenham Road, for H. Taylor; new Baptist Church, Leavesden Road, for the Trustees; two houses, Sandringham Road, for J. Bonham; two villas, The Avenue, Nascot Estate, for F. Gee.

WEALDSTONE.—Shop and workshop, for Freeman, Hardy & Willis, boot manufacturers, Newington Butts, E.C.

WEDNESFIELD.—New foundry at the Coalite Works.

WEMYSS (Fife).—New offices and inspector's house, for the Parish Council. G. C. Campbell, architect, Wemyss.

WESTON-SUPER-MARE.—House, Ashcombe Park Road. Harold A. Brown, engineer and surveyor, Town Hall, Weston-super-Mare.

WORSLEY (Lancs.).—New public offices for the U.D.C. J. T. Proffitt, architect, Longley Road, Walkden.

WORTHING.—New railway station for the London, Brighton and South Coast Railway Co.

YEOVIL.—Houses, Cromwell Road, for F. Bishop; St. Michael's Avenue, for A. G. Waygood; workshops, South Street, for Brown and Winsor.

NOTES.

A Merry Christmas to All.—The Electrical Review wishes all its friends the Compliments of the Season. To many the brief holiday will come as a very acceptable respite, and we hope that all will return to their usual calling filled with new ideas and new enterprise, ready to ensure a good year for the electrical industry during 1909.

Appointment Vacant.— Electrical Engineer for the South Indian Railway. See our "Official Notices" this week.

Electricity in a Shipbuilding Yard.—The following particulars of the extensive plant of the Fore River Shipbuilding Co., of Quincy, Mass., taken from the pages of the *Electrical Review and Western Electrician*, present some interesting electrical features:—"Although less than eight years old the company has contributed notable additions to the U.S. navy, and it is of interest to note that practically every part of that most complicated whole, a modern battleship, is made within its 78-acre enclosure. Notwithstanding the fact that every conceivable labour saving device is used, the normal number of men employed is upwards of 4,000. The range of buildings covers 12 acres, the principal structures being the machine shop, smiths' shop and power house. In addition to these a huge steel framework has been erected over one of the large stocks, for the purpose of carrying the four great cranes used for placing material in any part of a vessel beneath. It is divided into four bays, each containing one crane of about 80 ft. span, and capable of lifting 5 tons 100 ft. vertically.

"The machine shop is replete with tools of all kinds, and is especially remarkable for the number of large lathes, boring-mills, planers, &c. It contains also three great cranes—two of 25 tons, and one of 50 tons capacity.

"The smiths' shop—the third largest in the U.S.—contains 40 fires, and has a full complement of hammers. Adjoining it is the annealing plant containing oil-burning heating furnaces, and vertical cylindrical tanks for oil baths. The forge contains one 75-ton, and one 25-ton crane, for handling the immense ingots, crankshafts, gun parts, &c.

"Passing from the buildings to the shipyard, a great variety and number of electric travelling cranes, is at once noticed. The great crane, which reaches every part of the plate yard, is the largest of its kind in the world. It has a span of 175 ft., and a track travel of 1,000 ft.

"With the exception of the pneumatic tools and steam hammers, the driving of the whole of the works is electrical. About 75 per cent. of the motors are direct coupled to the machines they drive, the remainder being belted or counterbelted. Of the 275 motors, varying in size from ½ to 100 H.P., in use, the major portion was supplied by the Allis-Chalmers Co.

"Whilst the aggregate horse-power of all the motors is 3,800, the average load for power and lighting is only about 800 H.P.—a fact which speaks well for the economy of the system and the method of distribution and sub-division adopted. The lighting load consists of about 4,000 incandescent lights and 350 arc lamps.

"The current is distributed through about 1,000 ft. of subway and nearly one mile of pole line. The average centre of distribution is about 500 ft. from the power house switchboard, and each shop has its own set of mains coming up through the floor to a distributing board, from which the various machines are fed. In the case of the ship tool shop, the distribution board is placed on a gallery, and one attendant, who can thus see what is going on in any part of the shop, controls all the machines.

"The power house is centrally situated in a building 162 ft. long × 65 ft. wide. There are ten 6 ft. × 16 ft. return tubular boilers, working at 125 lb. per sq. in. No high chimney is necessary, as the Sturtevant system of induced draught has been adopted. The main generating plant consists of one 350-KW. horizontal steam turbine set, one 300-KW. compound condensing set, and one 200-KW. set, also steam-driven. The generators operate at 240 volts, and are direct-current machines. By means of a very interesting application of the Ward-Leonard multiple voltage system, a wide range of speed variation of the motors is possible. This is obtained by means of a balancer and a four-wire system of conductors. The balancer, which is situated in the engine room, consists of three similar machines mounted on a common base, and is designed to maintain pressures of 60, 80 and 110 volts between the various pairs of wires respectively. This, together with the aid of a small range of shunt field regulation, and by suitable connection of the motors through the regulating switches for proper combinations of pressure, renders the variation of motor speeds such that the highest is 6½ times the lowest. All machines, such as lathes, boring mills, slotters, drills, milling machines, shapers, cold saws, and a coil winder, where variation of speed is desirable, are worked on this four-wire system.

"The generator itself is operated on the two-wire plan, and supplies the highest voltage, 240 volts, between the outers. At this pressure all the constant-speed motors, crane motors, and the lighting mains are supplied."

Accumulator Traction on the Prussian State Railways.—Messrs. Felten & Guilleaume-Lahmeyer have recently completed a double accumulator car for the Prussian State Railways, which exhibits some points of novelty. It is composed of two carriages coupled together, with a driver's compartment at each end. There are two totally enclosed commutating-pole motors, each with an 85-H.P. one-hour rating, or 50-H.P. two-hour rating, geared to the car wheels through single reduction gear with a ratio of 1 : 4·2. The wiring of the car is carried out with asbestos and rubber-covered cables lying in a wood-lined channel under the floor, this channel being completely surrounded by asbestos-covered sheet metal. The charging plug is arranged with a magnetic interlocking device, which prevents it being withdrawn so long as any current is passing. By varying the arrangement of the plugs the batteries can be coupled variously in parallel and series, so as to suit the different charging voltages which may be met with. The plugs automatically introduce suitable resistance into the lamp circuits, so as to enable the lamps to burn steadily at their normal voltage, whatever the charging voltage may be. The braking arrangements include an air brake, electrical braking by means of the controller, and a hand brake workable from either end. In case the two carriages should be accidentally separated, the air brake is automatically applied. The controller handle also is arranged to introduce emergency electrical braking if released by the driver. A light spring keeps the handle usually slanting slightly upwards, and in this position the supply circuit is broken and the necessary connections for electrical braking are made. When the driver's hand depresses the handle a local circuit is made, which immediately closes the main cut-out and enables the controller to carry out the usual series-parallel operations. Should the driver release the handle at any point, it rises and returns to the off position. During the official trial of the brakes it was found that, when travelling at 36 miles an hour, the air brake alone pulled the car up in a distance of 220 yards, whilst when the electrical brake was employed simultaneously this distance was approximately halved. The complete double carriage with its two sets of accumulators weighs approximately 62 tons, and on the trial run, when travelling at 28 miles per hour on a length of track having several gradients of ·5 per cent. and some sharp curves, the consumption was found to be only about 19 watt-hours per ton-mile, including a single start. The cells enable the car to cover at least 62 miles with a single charge.—*E.T.Z.*, October 29th, 1908.

Electric Transport of Food.—The Children's Committee of the Metropolitan Asylums Board has considered the problem of serving hot meals to all the inmates at the children's infirmary, where, in addition to the administrative block, there are 48 cottages and two large hospitals, widely scattered over a site of 100 acres, which require to be supplied with hot meals from the central kitchen. The engineer-in-chief has designed a suitable electric motor-car carrying 5 cwt. which will supply 14 cottages, *i.e.*, rather over half of one side of the institution, in one journey. This journey will be made in 10 minutes, so that the meals for one-half of the cottages, when full, can be delivered in 20 minutes, or including a half of the hospital block, in half-an-hour. In the event of the institution filling up, two motor-cars would be necessary, but they anticipate that they will be used not only for food but for the delivery round the institution of other classes of goods, such as groceries, clean linen, &c. The car can be arranged to run 40 miles on a single charge, and the maximum speed would be 16 miles per hour. The engineer proposes to invite estimates from six selected firms. The cost of the vehicle is estimated at approximately £300, and the arrangements at the infirmary for charging the batteries will probably cost £50.

London County Council Turbines.—The following came to hand from the British Westinghouse Co., too late for inclusion in our "Correspondence" columns:—

"The object of Mr. Wüthrich's letter in the ELECTRICAL REVIEW of December 18th is not clear. Apparently he objects to the fact that the British Westinghouse Electric and Manufacturing Co. has obtained the contract, and assumes that it has been so awarded because of a possible misunderstanding of the facts on the part of the L.C.C. engineers. While we should prefer that your valuable paper and our time were devoted to a more useful purpose, we will ask your kind permission to reply to his letter.

"The reason which guided the British Westinghouse Co. in tendering upon an impulse type of turbine in this case was that the specification, principally on account of the speed, did not suit the type of machine which we have hitherto constructed. The facts were fully set forth in our tender to the Council, and information was included as to where turbines of the type recommended could be inspected, among which were mentioned the Milan machines. In this reference list we also included over 200 other turbines, all built or building under licence of the Rateau patents, several of which were in process of construction by the Rateau Co., of France. Incidentally it was mentioned that the British Westinghouse Co. were manufacturing turbines and generators at their Trafford Park works, and the inspection of the L.C.C. engineers was invited also thereto.

"It was, as Mr. Wüthrich states, after the engineers of the Council had seen one of the Rateau turbines at Milan, that they recommended the Westinghouse tender for acceptance; but he omits to add that it was also after inspecting turbines constructed by Prof. Rateau, in France, and also after inspecting Prof. Rateau's designs for large machines in process of building for the French Government; and, finally, it was after seeing the work being done at Trafford Park that the recommendation to the Council was made.

"There could never have been a question in the minds of the L.C.C. engineers that we were proposing to duplicate turbines as constructed by the company which Mr. Wüthrich represents, any more than there would have been a question as to whether any two of the Parsons licensees could or would build turbines similar in all their constructive details. Apparently the question resolved itself into whether the British Westinghouse Co., working as licensees under the Rateau patents, with the drawings and expert knowledge of Prof. Rateau, and backed by their own experience of turbo-generator construction, could supply apparatus which would conform to the L.C.C. specifications and meet their requirements, and the reply to that question was evidently in the affirmative, as our tender was accepted.

"O. H. BALDWIN,
"*District Manager.*

"London, W.C., *December 21st*, 1908."

In connection with this matter, Mr. Wüthrich writes to point out that the 2,500-KW. turbine at Milan came into use in 1907, not 1906 as stated in his letter.

Clock Synchronisation.—The question of the synchronisation of public (and other) clocks is a subject which periodically crops up, and which always results in "much cry and little wool"; the attempts that have been made from time to time to deal with the problem can only be regarded as spasmodic. There exists, of course, more than one company or firm which undertakes the synchronising business, and with some success, but the general question of public clock synchronisation never seems to have been properly tackled. The advisability, not to say the necessity, of having all public clocks made to "keep time" can hardly be questioned, but how the desirable end is to be brought about is still a problem. Undoubtedly the Postal Department is the one body which could carry out the work most satisfactorily, as that department has all the "means and appliances" for the purpose. The recent statement (in the *City Press*) that the well-known G.P.O. East clock is being synchronised is, we hope, some indication that the Postal Department is preparing to undertake the general work of synchronisation on an extended scale. If the various County Councils were to take the matter in hand in conjunction with the Post Office, a general scheme might certainly be devised, so that in every town where public clocks were displayed some guarantee of their correctness could be ensured.

The London Electricity Supply Bills.—In the House of Lords on December 17th, the amendments made in the House of Commons to both of the company Bills were approved.

Institution and Lecture Notes.—SOCIETY OF ENGINEERS.—On Wednesday last week the fifty-fourth annual dinner of this society took place at the Waldorf Hotel; Mr. J. W. Wilson, M.Inst.C.E., the president, occupied the chair. After the loyal toasts, the president gave the "Imperial Forces," and remarked that the army had been going through the melting pot, with the usual result that, while being refined, it was also reduced in size; he approved of compulsory military training, which he thought would be of benefit to everyone. In reply, Admiral Sir E. R. Freemantle said that while the Navy was still up to the two-power standard, Germany was rapidly overtaking us, and we ought to build ships boldly without delay. Lieut.-Gen. D. Hutchinson said the Army was useless unless rooted in the nation, and urged the members to join the special reserve of officers in the Royal Engineers.

Proposing the "Society of Engineers," Sir A. R. Binnie congratulated the members on the strong position of the society in both membership and finance, and said that the engineering profession was passing through a period of depression consequent upon

the recent wars, and upon the heavy outlay upon communications in London. He emphasised the necessity of raising the status of engineers, and said that a committee of the Civil Engineers was considering the matter. In reply, Mr. Wilson, after announcing the awards of medals and premiums for papers, stated that next year being the jubilee of the Civil and Mechanical Engineers' Society, it was proposed to amalgamate the two societies on that occasion. They were prepared to support a movement towards raising the status of engineers and preventing unqualified men from practising as such. He urged the Press to give due credit to engineers for their achievements, and concluded with a reference to the loss of the late secretary, Mr. P. F. Nursey, and to the energy and ability of his successor, Mr. A. S. E. Ackermann.

Mr. Silcock toasted "Kindred Institutions," and Mr. Mordey, in reply, warmly supported the movement for reform, advocating combination. He also gave data to show that Britain was not lagging behind Germany in electrical engineering. Mr. D. A. Symons proposed "The Guests," and Mr. H. D. Sells Wood briefly replied.

During the evening a programme of songs was performed, and nothing was wanting to ensure the enjoyment of the guests.

Birmingham and District Electric Club.—The fourth annual meeting of the members of this club took place on the 12th inst. A satisfactory report was presented on the year's work, and the financial position of the club was also a matter for congratulation. Mr. George T. Wood was elected president, and Mr. W. G. L. Riddle, 82, New Street, secretary.

Walthamstow Tramway Employés' Recreation Club.—A meeting of this club was held on Wednesday, 16th inst., with Mr. W. Murray (president) in the chair, supported by Mr. W. J. Stevens (vice-president), and Mr. A. H. Lord (hon. treasurer). In view of the success attending the recent masked ball held by the club at the baths, it was unanimously agreed that a donation of a guinea should be sent to each of the following:—Walthamstow High Street and St. James' Street Benevolent Fund. Walthamstow Wood Street Benevolent Fund, and the Xmas Hamper Fund. It was also agreed that a Christmas treat should be given to a number of children, commencing with a tea, and followed by an evening's entertainment; with a Xmas tree as a special feature.

Electric Shock Fatalities.—Our South African correspondent writes that a young electrician named Tapsoll had been killed instantaneously by coming into contact with live wires in one of the sub-stations of the North Randfontein Gold Mine. Tapsoll was 21 years old, and came to the Rand from Griqualand West.

Plymouth Electrical Territorials. — Plymouth Corporation Electrical Committee has decided to recommend to the Council that such employés who were members of the Territorial force should, to enable them to attend camp, be granted eight days' holiday annually, instead of seven, with full pay, irrespective of any pay they might receive from the Government. It was also decided to recommend that the labourers paid by the hour who had been in the employ of the Committee for more than 12 months, should be given the option of being placed on the weekly wages list, which would entitle them to receive seven days holiday annually.

Errata.—In the article on Electricity Supply, on page 1082, the following errors occur:—Line 1, November 11th for Heft 11; line 39, verification for rectification.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Our Acton correspondent writes:—Among members of the Acton U.D.C. common sense has at last asserted itself. So-called scandals in connection with the electricity department have gained a certain amount of notoriety for Acton during recent months. Discharged employés made any number of charges, more or less serious, against the engineer, Mr. J. Martin Blair, and his assistant, Mr. Harding, and certain members of the Committee deemed them of sufficient importance to institute an investigation, which was again and again adjourned, and finally culminated in recommendations to the Council expressing regret in so far as the engineer was concerned, and that his assistant, who was said to have used bad language to the staff under him, be discharged. The Council had before it the recommendations last Friday evening, and a notice of motion by the vice-chairman inviting the engineer to state that he would terminate his engagement within six months. The latter, however, was negatived, and the Committee's report was altered to a mild censure in the case of Mr. Harding, instead of giving him a month's notice. In the absence of Councillor Eydmann, two other notices of motion were not considered, and it is to be hoped that the whole matter has now been finally disposed of.

General.—Mr. E. Kilburn Scott, A.M.Inst.C.E., M.I.E.E., has resigned his position at the University of Sydney, and will return to London at the end of this year to resume professional work. During the last four years he has organised and equipped the Electrical Engineering Department of the P. N. Russell School of Engineering, now housed in a new three-storey building, that compares favourably with Engineering Schools elsewhere. Amongst other professional work Mr. Kilburn Scott has advised the N.S.W. Government regarding the electrification of railways, and the Bendigo City Council regarding the electric light and tramway rating, and he has acted as expert to the N.S.W. Public Service Board. He was associated with Messrs. Coane, of Melbourne, in the Trawool dam irrigation and electric power scheme referred to in the Railway Electrification report of Mr. C. H. Merz. Mr. Scott also reported on a proposed carbide of calcium factory near the Barron Falls, Queensland.

Mr. Geo. Banford, late engineer to Messrs. H. Faulder & Co., Squirrel Works, Stockport, has joined Messrs. John Horn (Stockport), Ltd., Stockport, as chief engineer.

THE FUTURE FINANCIAL POSITION OF MUNICIPAL ELECTRICITY SUPPLY UNDERTAKINGS.

By "INTERESTED."

What the future has in store none can tell. We can only surmise, or draw our own conclusions from the present state of affairs. At the present time those interested in municipal electricity supply stations are trying to forecast their future financial positions. Here is my conclusion, and how it is arrived it.

The present position of affairs is as follows: All necessary working capital to carry on a business of this description is obtained by taking up loans at varying terms of interest (according to the state of the market) repayable in annual instalments extending over a number of years. Now let us take a favourably situated station which has been working for, say, 10 years, and which has shown a profit on each year's business. A certain amount of the borrowed capital has been redeemed, and the necessary interest on the sum borrowed paid up. Continuing under these conditions for a period of 35 to 40 years would see all the capital charges extinguished, and, to use the office-boy's expression, "The sinking fund would have sunk." This is taking for granted that no further loans were obtained for extensions, but are these conditions possible? I think not. Facts prove it to be otherwise, and, if the past 10 or 12 years is any guide to the future, additions will always be necessary, perhaps not so frequent as in past years, but an electricity works must grow to pay its way. It cannot stand still, as it were, because larger and more economical generating sets, boilers, &c., make the original small plant obsolete so far as efficient working goes, and the accounts of a works will not stand heavy items continually being debited for scrapped plant. Again, a station would be handicapped if it were to stop putting in more up-to-date and efficient plant, owing to modern conditions reducing the cost of generating electricity. I admit that prices to-day charged for energy are low, and the cost of production is nearly rock bottom; but it must be remembered that a fraction of a penny per unit will weigh heavily in favour of any new concern, such as that of a bulk supply station. Not a word about the possibilities of gas.

At this stage we come face to face with *the* question. Is it the intention of our councillors ever to free the undertakings from their heavy capital charges? If so, vastly different methods will have to be adopted in their accounts; larger portions of capital must be redeemed each year; less put to the relief of the rates; and as much as is possible of all future additions and extensions must be paid out of revenue account, so as to make the sinking fund really sink and not grow as in most cases just now. If not, then some day I can foresee the Committee finding the annual redemption and interest figures adding up to more than the profits for the year. What then?

The matter is reduced to these hard facts: The amount of capital repaid annually must be increased, so as to really reduce the sinking fund; the smaller additions and extensions will have to be met out of revenue account; instead of applying a large portion of the profits to the relief of the rates, the money will have to be placed to reserve in order to meet calls on account of depreciation, or heavy maintenance charges.

Many readers may not agree with me on this question, but I would ask those carefully to weigh the present-day facts and figures with the probabilities of the future before coming to a hasty decision. Also, this matter is well worth the careful attention of aldermen and councillors interested in such ventures.

NEW COMPANIES REGISTERED.

Transvaal Hydraulic Power Syndicate, Ltd. (100,665).—This company was registered on December 12th, with a capital of £20,000 in £1 shares (15,000 "A" and 5,000 "B"), to exploit and investigate water power in the Transvaal or elsewhere, to pay preliminary, engineering, and other fees and expenses in connection with the acquisition of any option contracts, rights and benefits, and to take over from the Transvaal Power Development Syndicate, Ltd., or others, contracts, rights, options, agreements, privileges and benefits, to carry on the business of electricians and mechanical engineers, &c. The subscribers (with one share each) are: H. Barnes, 351A, Wandsworth Road, S.W., clerk; C. J. Lunn, 17, Townsend Road, South Tottenham, N., clerk. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; qualification, 500 shares. Registered office, 24, Coleman Street, E.C.

Omega Electric Lamp Co., Ltd. (100,678).—This company was registered on December 14th, with a capital of £1,000 in £1 shares, to carry on the business of manufacturers of and dealers in incandescent electric and other lamps, dynamos, motors, accumulators, batteries, cells, apparatus, fittings and plant, &c. The subscribers (with one share each) are:—R. E. Haywood, 8, Cottesmore Gardens, Kensington, W., engineer; J. A. Scoular, 23, Normanton Avenue, Wimbledon Park, S.W., electric lamp manufacturer. Private company. The number of directors is not to be less than two or more than five; the first are R. E. Haywood and J. A. Scoular; remuneration as fixed by the company. Registered by Walls, Stallard & Newton, 27, Old Jewry, E.C.

Gravity Flame Arc Lamps, Ltd. (100,733).—This company was registered on December 17th, with a capital of £5,000 in £1 shares, to acquire from F. Blankensee and others certain patents for inventions relating to Gravity flame arc lamps, and to carry on the business of manufacturers of electric lamps and electrical apparatus, electricians, mechanical engineers, suppliers of electricity, &c. The subscribers (with one share each) are:—H. Mosey, 12, Carlingford Road, Hampstead, N.W., land and estate agent; F. Sidney, 2, Church Court, Clement's Lane, E.C., clerk; T. Howe, 3, St. James's Road, Lower Edmonton, electrical engineer; W. T. Hick, 2, Church Court, Clement's Lane, E.C., solicitor; C. L. Kettridge, 1, London Wall Buildings, E.C., incorporated accountant; D. Cameron, 1, The Gables, Hampstead Heath, editor; H. Diamant, 2, Church Court, Clement's Lane, E.C., physician. Minimum cash subscription, £100. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; remuneration (except managing director), £50 per annum and 10 per cent. of the net profits available for distribution, divisible. Registered by W. T. Hick, 2, Church Court, Clement's Lane, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electromobile Co., Ltd. (London), (75,139).—Particulars of £50,000 debenture stock, created by resolution of December 9th, 1908, and secured by a trust deed of even date, have been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £40,000. The above-mentioned trust deed and charge of even date under the Land Transfer Acts, 1875 and 1897, have also been registered. Property charged: Land and buildings in Hertford Street, Mayfair, and the company's undertaking and other assets, including uncalled capital. Trustees: North of England Trustee, Debenture and Assets Corporation, Ltd. Mortgage dated December 8th, 1908, and charge of even date under Land Transfer Acts, 1875 and 1897, securing £20,000. Property charged: Land and buildings in Hertford Street, Mayfair. Holders: W. L. Agnew, 43, Old Bond Street, W., and T. C. Ansdell, Beechhurst, Pendleton, near Manchester.

Memoranda of satisfaction in full (*a*) of a mortgage dated March 25th, 1908, securing £12,000; and (*b*) in full of a charge dated 21st August, 1906, securing £18,740, have been filed.

CITY NOTES.

The Shanghai Electric Construction Co., Ltd.

The second annual general meeting of the shareholders of this company was held on Thursday of last week at the offices, 54, Old Broad Street, Sir Alfred Dent, K.C.M.G., presiding.

The Chairman, in proposing the adoption of the report, said that Mr. Donald McColl arrived at Shanghai in June to take up the position of general manager, and from reports received since, they were thoroughly satisfied that their interests there were in excellent hands. Owing to the delay on the part of the council, they were only able to commence a partial running of the trams for public purposes on the south side of the Soochow Creek on March 5th, and owing to the delay over the bridges they did not get the whole system on both sides of the Creek into operation until nearly the end of May. The present accounts, therefore, which only took in about 36 days' full working of the whole system could only be regarded as experimental, and afforded no indication of what they were likely to do in the future. The gross receipts from March 5th to June 30th amounted to £9,045, less operating expenses and royalty amounting to £8,420, leaving a surplus of £624. During many months of delay while the plant was lying idle, wages and salaries were going on at considerable cost. The contractors themselves were not ready by the contract time to hand over a completed system, and for their share in the delay the company intended to hold them responsible. It was, however, represented to the Municipal Council that by October 4th, with the exception of certain junctions, the tramway was ready for running, but an offer to make temporary junctions before October 10th was not approved. The Council could not well press the contractors to complete their system by October 10th, when it was well known that their own work would not be completed until the following year. As regarded the running agreement with the French company, no arrangements had yet been made for linking up the two systems, and it seemed likely that some modification of the original scheme would have to be made, principally on account of the less desirable mode of construction which had been adopted on some portions of the French line. Last year he referred to overtures which they had made to the Council for the purchase of their electrical undertaking. Those proposals were rejected by the ratepayers in 1907, and although the matter was again brought forward in March of the present year no progress had been made, and the negotiations had been practically suspended. The experience which they had had of their receipts from July 1st to the end of November had shown them that no adequate profit could be realised so long as they remained on their present basis, and subject to the restriction placed upon them to reserve such a large portion of their seating accommodation for third class passengers. A new basis of fares and distances was accordingly drawn up by their general manager, and laid before the Council. It was still under consideration, but they had good reason to hope that the Council would meet their views in the matter. It seemed to them that much greater latitude might be left to them in that respect, and that they might well be trusted to fix their own fares subject only to interference if it were shown that they were not adequately meeting the requirements of the public. The average receipts had been less that 5d. per car-mile as against a prospectus estimate of 8d., while their expenses had been 4½d., as against an estimate of 4d. They might probably be able to bring down the expenses to 4d., but the receipts could only be increased by a rearrangement of fares and of seating accommodation in the cars. The Municipal Council were fully aware of the position, and within the last few days it had been suggested that a sub-committee of their local board should be appointed to meet a small sub-committee of the Council. They had reason to hope that they would derive substantial benefit from such a conference. One of the main questions which the Committee would have to deal with was a claim they had put forward for compensation for the delay in supplying power and completing the bridges. If they could establish their claim, a large amount would be payable to the company. The present suggestion of the Council seemed to be that the company should not press this claim, but trust to their generosity to settle the matter equitably by concessions in other directions. The board were considering what instructions they should send out to the committee in Shanghai to meet the views of the Council, and as the tenour of their latest advice encouraged them to the belief that they would be dealt with fairly, if not liberally, should the claim be withdrawn, it was probable that they might comply with that request. The future of the success of the undertaking depended upon their ability to decrease the working expenses, but the question of paramount importance was that of a rearrangement of fares and sections. Their proposals to that end would not make any appreciable difference to the travelling public as a whole. They had reason to believe that the public were inclined to adopt the proposals, and they were not without hope that the Council would see their way to approve them. Should their sanction be obtained, he was confident that they would be able to show a marked improvement in results, and would be accommodating the Shanghai public with about the cheapest tramway system in the world.

M. Emile Francqui seconded the motion, and the report was adopted.

Adelaide Electric Supply Co., Ltd.

The fourth annual general meeting was held on Monday at the offices, Finsbury Pavement House, Finsbury, Mr. J. B. Braithwaite presiding.

The Chairman, in moving the adoption of the report, said that the past year had been one of great activity and of most gratifying progress, which was reflected in the balance-sheet. The preference shares now issued amounted to £135,000, as compared with £75,000 last year. They had expended in round figures £40,000 on additional plant and development of the mains. The item of expenditure now stood at £251,874, as compared with £211,188. Cash at bankers, and in deposit was £10,634, as against £11,000. Debtors were slightly up. The suspense account was down by the £5,000, which was written off last year. Turning to the profit and loss account, the revenue from private lighting had risen from £14,886 to £19,155, and there had also been an increase in the business done on the power side. The total revenue was £28,287, as against £22,624. They had a credit balance of £12,962, and after paying the interest on the preference shares, writing £606 off the suspense account, placing £1,000 to depreciation, and carrying forward £879, they were able to recommend the payment of a dividend of 3½ per cent. on the ordinary shares, an increase of 1 per cent. As to the general working of the company, they had closed down the small and uneconomical station at Port Adelaide, and they now had a main running right through from Adelaide. As a result of that, they now had lighting connections at Thebarton, Hindmarsh and Woodville. They had also extended their mains to the suburbs of St. Peter's, Kensington, Burnside and the large district of Horley. Another interesting point was that they had entered into a contract with the Tramway Trust to supply them with electrical power for two years. All the engineering extensions

necessary for the increased demands had been carried out by their own staff. The company had an area of nearly 70 square miles, and they had got 85 route-miles of mains. They had connections equal to 64,961 16-c.p. lamps. The business had increased all round, and he thought they would agree that the additional expenditure incurred recently had been justified. They had agreed, at the request of many local people, to extend the mains to Glenesk if the demand should justify their doing so.

Mr. R. Percy Sellon seconded the motion, and the report was adopted.

Provincial Tramways Co.

The fifty-first ordinary general meeting of this company was held on Friday last at the offices, Moorgate Street Chambers, Moorfields, Mr. Andrew Beattie, J.P., presiding.

In moving the adoption of the report, the Chairman said that the receipts were £33,083, as compared with £38,048, a diminution of £4,964. The company was one of the oldest tramway companies in the kingdom, and they had had successes for a great number of years. In 1905 their receipts were £26,050; 1906, £30,992; 1907, £38,048; and this year £33,083. He would remind the shareholders that last year was the best since the company's existence, so that this year was the second best. One of the causes which had tended to decrease the receipts, had been the bad weather. On June 13th they were £1,262 to the good, but that was all wiped away before the end of the year. Other causes had also operated particularly at Grimsby and Plymouth. In the first-named town there was a general depression in trade. They would remember that in 1907, the visit of the Fleet to the town, increased their receipts by £1,000. At Plymouth the same depression existed. Then, again, the net profits of the local companies were £3,093 less. There had also been increases in expenses; coal alone accounted for £739, wages showed an increase of £353, rolling stock £638, and rates and taxes £141, so that adding those items up they had a total of £1,871, which, with the £3,093 he had referred to, made up the decrease in their net profit. He would point out that in some of their local undertakings there were fixed charges. For instance, they had to pay for crossing over a bridge between Devonport and Stonehouse, £1,500 a year, which represented 7½ per cent. on the takings of that line. As to the future, already the working for the first 2½ months of the current financial year showed them between £400 and £500 up. The company was worked economically and everything was done for the benefit of the shareholders, and he hoped that next year the accounts would be much better than they were now, if not up to that of last year's record.

Mr. S. Hern seconded the motion, and the report was adopted.

Prior to the meeting of the Provincial Tramways Co., the ordinary general meetings of the Plymouth, Stonehouse and Devonport Tramway Co., Great Grimsby Street Tramway Co., Portsmouth Street Tramway, Cardiff Light Railway, Gosport and Alverstoke Light Railways, were held. Mr. Andrew Beattie presided. The business was purely formal, and the reports were adopted in each case.

United Electric Tramways of Monte Video, Ltd.

An extraordinary general meeting of the shareholders was held on Monday at Winchester House, Mr. Geo. A. Touche, presiding.

The Chairman, after referring with regret to the death of the late chairman of the company, Mr. William Trotter, said that the object of the meeting was to obtain the sanction of the shareholders to increase the capital of the company from £800,000 to £1,000,000 by the issue of a further £100,000 in preference shares and a like amount in ordinary shares to rank *pari passu* with the existing preference and ordinary shares of the company, The directors had explained to the shareholders very fully in the circulars sent them, why the increased capital was necessary. The figures which they then gave of the gross receipts were a striking example of the expansion of traffic which had been created by electric traction. It must be remembered, however, that those results had been obtained during a period of transition from animal to electric traction, and under the disadvantages consequent thereon. In arranging for the company's financial requirements, in anticipation of electrification, the directors only had estimates to proceed upon. They then estimated traffic receipts of £255,000 when the whole of the lines were operated during an entire year under electric traction. So far, however, they had not experienced a full year's working of the whole of the lines under electricity, as a great part of the Union line was not operated electrically until July 23rd last. The total length now being operated was 77¼ miles, and ultimately it would be 84 miles. In the year ended October 31st last the gross receipts had amounted to £232,738, as against £199,037 in the preceding 12 months; equal to an increase of 17 per cent. The passengers carried had increased by 21 per cent. If, however, they compared 1908 with 1906, when the lines were operated entirely under animal traction, there was an increase of 79 per cent. in the gross receipts and an increase of 87 per cent. in the number of passengers carried. He might point out that the results obtained last year were forthcoming in spite of unfavourable climatic conditions. Their managing director had told them that he was unable to cope with the traffic on Sundays and holidays, owing to not having a sufficient number of cars. A further 25 trailers had been ordered, and would shortly be completed and shipped to Monte Video, but this would not be sufficient, and more semi-convertible cars were required. Before these additional cars could be put into service, the power house plant must be increased, and this all meant further additional expenditure. It was also proposed, for the better and more economical handling of the traffic, to lay down double track on some of the routes at present operated by single track with loops; and other improvements of this nature were at present receiving the careful consideration of the directors. Within the next two years the board estimated that they would require to spend an additional £228,000. Opportunities for developments were constantly presenting themselves on tramways, the same as on railways, and there could be no doubt that extensions prudently made added largely to the prosperity of the business. He wished it to be understood that there would not be any pressure for additional funds for some months, but the board, as prudent men, must make their plans in advance in order that they might issue the necessary capital as the occasion arose. He concluded by moving the following resolutions, which were agreed to:—

(1) That the capital of the company be increased from £800,000 to £1,000,000 by the creation of 20,000 further 6 per cent. cumulative preference shares of £5 each, ranking *pari passu* with the existing 6 per cent. £5 cumulative preference shares of the company, and 20,000 further ordinary shares of £5 each ranking *pari passu* with the existing £5 ordinary shares of the company, and that the board be authorised to issue the same from time to time, at such times in such manner to such persons and upon such terms as to price or credited as fully paid and otherwise, and carrying dividends from such date as the board may think fit. (2) That in addition to the borrowing powers conferred upon the board by Article 19 of the Articles of Association, the board be authorised to borrow further moneys by way of temporary loan from time to time upon such terms and security or without security, as they may think fit, provided that the moneys so raised do not in the aggregate exceed 10 per cent. of the share capital authorised for the time being. (3) That the directors of the company who have acted as a construction committee during the carrying out of the work of electrification be paid a special remuneration at the rate of £750 per annum, divisible as the directors may determine.

Subsequently a meeting of debenture-holders was held, at which a resolution was passed authorising the directors to issue a further £200,000 5 per cent. debenture stock, to rank *pari passu* with the £798,000 of such stock at present outstanding.

West Paris Electricity Co.

The report for 1907-8 of the directors of the Compagnie d'Electricité de l'Ouest-Parisien (Ouest-Lumière), which has now entered upon its ninth financial year, states that the Société l'Union des Gaz, to which the company supplies current, has extended its distribution to the communes of Celle-Saint-Cloud, Croissy and Louveciennes. Thus the number of communes supplied by the West Paris Co., either directly or through the intermediary of distributing companies, has risen from 21 to 24. A contract has been concluded for the supply of a considerable portion of the energy required for several tramways, and the company commenced the delivery of current to the Union des Secteurs on February 14th, 1908. The works commenced at the generating section in 1906-7 could not be completed during the financial year owing to delay on the part of contractors, and the difficulties in working arising therefrom influenced the results by materially increasing the working expenses. The starting of the second steam turbine is impending; the first four boilers in the new boiler house are in service, and a second group of similar boilers has been ordered. A generating set, specially intended for supplying current to the Union des Secteurs, is also about to be put in operation. It appears that the population served directly by the company numbers 270,038 persons, and the customers increased from 6,737 in 1906-7 to 8,200 in 1907-8. The plant installed for lighting rose from 4,824 kw. in 1906-7 to 5,837 kw. in 1907-8, and that for motive power purposes, exclusive of tramways, was 8,295 kw. and 9,631 kw. in the same years respectively, the number of transformers having similarly advanced from 586 to 617. The receipts from lighting experienced an increase of 17·5 per cent. in 1907-8 as contrasted with the preceding year, and those from the supply of motive power, including tramways, expanded by 9·4 per cent. The accounts for 1907-8 show, together with the amount brought forward, a credit balance of £43,200, of which the sum of £12,000 has been placed to the general redemption account. Out of the remainder, 5 per cent. has been allocated to the legal reserve fund, and a dividend of 6 per cent. has been declared on the share capital of £480,000, leaving a balance of £880 to be carried forward to the next account.

Prospectus.—*South London Electric Supply Corporation, Ltd.*—This company has been offering for subscription an issue of £100,000 five per cent. first mortgage debenture stock at par, which is required for paying off an overdraft at the bankers and for extending the company's undertaking. The list closed on Wednesday, December 23rd.

Telephone Company of Egypt, Ltd.—The register of transfers of 4½ per cent. redeemable debenture stock will be closed from December 18th to 31st, both days inclusive, for the preparation of warrants for the half-yearly interest due January 1st, 1909.

Oriental Telephone and Electric Co., Ltd.—The register of transfers of 4 per cent redeemable debenture stock will be closed from December 18th to 31st, both days inclusive, for the preparation of warrants for the half-yearly interest due January 1st, 1909.

MARKET QUOTATIONS.

Monday, December 21st.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
	Acid, Hydrochloric	per cwt.	8/- ..
a	" Nitric	per cwt.	22/- ..
a	" Oxalic	per cwt.	28/- ..
a	" Sulphuric	per cwt.	5/6 ..
a	Ammoniac, Sal	per cwt.	42/- ..
a	Ammonia, Muriate (crystal) ..	per ton	£33 10 ..
a	" " "	per ton	£30 ..
a	Bleaching powder	per ton	£5 10 ..
a	Bisulphide of Carbon	per ton	£18 ..
a	Borax	per ton	£16 ..
a	Copper Sulphate	per ton	£21 ..
a	Lead, Nitrate	per ton	£33 10 ..
a	" White Sugar	per ton	£23 ..
a	" Peroxide	per ton	£32 ..
a	Methylated Spirit	per gal.	2/6 ..
a	Potassium Bichromate, in casks	per lb.	5½d. ..
a	Potash, Caustic (75/80 %) ..	per ton	£20 ..
a	" Chlorate	per lb.	8½d. ..
a	" Perchlorate	per lb.	9d. ..
a	Potassium Cyanide	per lb.	7d. ..
a	Shellac	per cwt.	90/- 5/- dec.
a	Sulphate of Magnesia	per ton	£4 10 ..
a	Sulphur, Sublimed Flowers ..	per ton	£6 10 ..
a	" Recovered	per ton	£5 10 ..
a	" Lump	per ton	£5 ..
a	Soda, Caustic (white 70 %) ..	per ton	£10 15 ..
a	" Chlorate	per lb.	3½d. ..
a	" Crystals	per ton	£3 5 ..
a	Sodium Bichromate, casks ..	per lb.	6d. ..
a	" Cyanide (basis 100 %) ..	per lb.	7d. ..
	METALS, &c.		
b	Aluminium Ingots, in ton lots ..	per ton	£70 ..
b	" Wire, in ton lots ..	per ton	£112 ..
b	" Sheet, in ton lots ..	per ton	£120 ..
c	Babbitt's metal ingots	per ton	£50 to £140 ..
c	Brass (rolled metal 2" to 12") basis	per lb.	7½d. ..
c	" Tube (brazed)	per lb.	9d. ..
c	" " (solid drawn)	per lb.	8d. ..
c	" Wire, basis	per lb.	6½d. ..
c	Copper Tubes (brazed)	per lb.	9½d. ..
c	" " (solid drawn) ..	per lb.	9½d. ..
g	Copper Bars (best selected) ..	per ton	£76 £1 dec.
g	Copper Sheet	per ton	£76 £1 dec.
g	" Rod	per ton	£76 £1 dec.
c	" (Electrolytic) Bars ..	per ton	£66 10 ..
c	" " Sheets ..	per ton	£83 ..
c	" " Rod ..	per ton	£71 ..
c	" " H.C. Wire	per lb.	8½d. ..
f	Ebonite Rod	per lb.	8/8 ..
f	" Sheet	per lb.	8/- ..
m	German Silver Wire	per lb.	1/6 ..
h	Gutta-percha, fine	per lb.	5/6 to 6/6 ..
h	India-rubber, Para fine	per lb.	5/1 inc.
i	Iron Pig (Cleveland warrants) ..	per ton	48/6 6d. dec.
i	" Wire, galv. No. 8, P.O. qual.	per ton	£14 ..
g	Lead, English Ingot	per ton	£13 12 6 inc.
m	Manganin Wire No. 28	per lb.	8/- ..
g	Mercury	per bot.	£8 10 ..
d	Mica (in original cases) small ..	per lb.	6d. to 1/- ..
d	" " " medium	per lb.	2/6 to 4/- ..
d	" " " large ..	per lb.	4/6 to 8/6 ..
p	Phosphor Bronze, plain castings	per lb.	1/0½ to 1/2 ..
p	" rolled bars & rods	per lb.	1/2½ to 1/8½ ..
p	" " strip & sheet	per lb.	1/3 to 1/6 ..
o	Platinum	per oz.	84/- ..
e	Silicium Bronze Wire	per lb.	9½d. ..
r	Steel, Magnet, in bars	per ton	£55 ..
g	Tin, Block (English)	per ton	£130 10 to £131 10 10s. inc.
n	" Wire, Nos. 1 to 16	per lb.	1/10 ..
p	White Anti-friction Metals—		
	"White Ant" brand	per ton	£35 to £60 ..
k	Zinc, Sh's (Vieille Montagne bnd.)	per ton	£24 15 ..

Quotations supplied by :—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

Companies to be Struck off the Register.—The following are to be struck off the register in three months unless cause is shown to the contrary :—

British Blahnik Arc Light Co., Ltd.
Electrical Investment Syndicate, Ltd.

American Telephone and Telegraph Co., Ltd.—It is announced that the regular quarterly dividend of $2 per share is payable on January 15th.

France.—La Société des Téléphones, of Paris, reports a profit of £73,634 for the last financial year, as compared with £71,128 in the preceding twelve months.

Leyland and Birmingham Rubber Co., Ltd.—An interim dividend at the rate of 5 per cent. per annum is announced.

STOCKS AND SHARES.

Saturday Afternoon.

Christmas markets are very much the order of the day, and business in several departments threatens to come to a full stop. Investment, however, continues to make its influence felt, and the remarkable success achieved by certain of the recent new issues is additional evidence that money is wide awake to opportunities for acquiring cheap stock, even at this "window-dressing" period of the year. Amongst the latest applicants for capital is the South London Electric Supply Corporation, which offers a million pounds 5 per cent. first mortgage debenture stock at par.

The progress of the Companies' Bill through Parliament has served to steady the electricity supply shares, but no changes of significance have taken place. City of London Ordinary shares are 2s. 6d. better, London Electric Ordinary 2s. 6d. lower. These are all the movements since we last wrote. The advance in metropolitan companies' shares has spread to some of the provincial issues, although, of course, the sympathy is purely sentimental. Oxford shares are 2s. 6d. up. Hove are 3s. 9d. to the good.

Mexican Light descriptions have again improved, the 7 per cent. Preferred gaining 1½ at 106. Mexican Electric Light 5 per cent. gold bonds rose 1½. Other shares in this group are good. Shawinigan Water and Power Ordinary stock rose to 82½, the 5 per cent. First Mortgage bonds being 104 and the 4½ per cent. Perpetual Debenture stock 93½. Canadian General Common shares are steady at 111, and the 7 per cent. cumulative Preference stock remains about 115.

The tramway issues of the same division are less firm. Sao Paulo lost a point at 159 and Rio shares declined to 79. No change occurred in Mexico trams, which keep about 139.

Rather curious was an offer the other day of Gateshead and District Tramways Ordinary shares, of £10 each, at a discount of 25s. It is, of course, illegal to issue shares at a discount, but the prospectus pointed out in big black type that this was not a new issue, and that the bankers were accepting applications on behalf of the vendors of the shares. The second payment is not to be on "allotment," it is to be on "allocation." The somewhat unusual nature of the prospectus—we hope we give no offence in calling it such—marked it out for particular attention.

Telegraph stocks and shares are still unable to shake off the effects of the latest demands for cheap cables, and the Anglo-American issues, in particular, are flat. Anglo-American Preferred has shed 2 more points, making 6 this week, and the market professes to look for a bad dividend statement next month. Commercial Cable Debenture stock fell 2, but Direct United States remained at 13. Eastern Extension shares eased off ¼, Westerns ⅛, and Indo-Europeans fell no less than £3 upon a very slight amount of offering of shares. Owing to the general decline in Telegraphs, Globe Ordinary shed 5s., which brought down the price to a shade below the par value of £10.

An error in transmission of a code cable cost a firm of stock-brokers £300. The firm claimed compensation, which was, of course, refused. After months of correspondence, the cable company wrote that it desired to close the matter, and would therefore meet the injured parties in their claim. The compromise proposed was that the company should return the cost of the cable; the sum running into the munificient total of 3s.!

Home Railway stocks received a little benefit from publication of the preamble of the Bill for the working agreement between the Great Northern, Great Central and Great Eastern. Others besides the stocks immediately affected were advanced, but the vicarious aid did not spread so far as the tube railways. City and South London is down to 28½, a figure suggestive of market fears with regard to the coming dividend declaration. A year ago it was 17s. 6d. per cent. actual, and for the six months to date the company's traffics show a falling off of £2,436. Metropolitan Consolidated came down for no apparent reason, stock changing hands at 35½, though Districts were allowed to retain their rise of last week. The Central London is asking for powers to extend its lines to Liverpool Street and Broad Street Stations, so that another issue of stock may be expected if the Bill goes through Parliament.

Brush Ordinary and Preference have been restored to the honour of official quotation in the Stock Exchange daily list, but proprietors who look at the price will agree that the honour is literally an empty one. Industrials are slightly easier on the week. Babcock and Wilcox yielded ⅛; so did Castner-Kellner and Edison & Swan partly paid shares. The amount of business doing in this department, however, is so trifling as to form no excuse for stopping to write about it on the afternoon—of all times—of the Saturday before Christmas, when conscience hurls defiance at editorial exigencies, and cries havoc to the purses of those whom she pitilessly pushes into the shops where they sell toys for the children.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue. £	NAME.	Stock or Share. *	Dividends for the last four years. 1904.	1905.	1906.	1907.	Closing Quotations Dec. 15th.	Closing Quotations Dec. 18th.	Business done week ended Dec. 18th, 1908. Highest	Lowest.	Rise + or Fall −	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2¼ — 2½	2¼ — 2½	..	..	..	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	5 %	5 %	5 %	92 — 95	92 — 95	..	..	..	5 5 3
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7¼%	7½%	8 %	8 %	132 —135	131 —134	..	..	−1	5 19 5
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	96 — 98	95 — 97	..	..	−1	4 2 6
598,180	Anglo-American Telegraph	Stock	28%	31%	33%	34%	55 — 58	55 — 58	..	..	..	6 0 8
3,200,910	Do. do. do. 6 % Pref.	Stock	5½%	6 %	6 %	6 %	97½ — 99½	95½ — 97½	98	93	−2	6 3 1
3,200,910	Do. do. do. Deferred	Stock	Nil	⅛	12½	1 %	15⅜ — 15⅝	15⅜ — 15⅝	15⅝	15½	..	6 8 0
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	8 — 8½	8 — 8½	..	..	..	4 14 1
2,383,376	Commercial Cable Stlng. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	87 — 89	85 — 87	88	86½	−2	4 12 0
16,000	Cuba Telegraph	10	5 %	5 %	5 %	6 %	7½ — 8½	7½ — 8½	8	..	..	7 1 2
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16½ — 17½	16½ — 17½	16⅞	..	..	5 15 11
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	5 14 3
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	10 %	10 %	8 — 9	8 — 9	..	..	..	5 8 1
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —108	100 —108	..	..	..	8 14 10
60,710	Direct United States Cable	20	3½%	4½%	4½%	4½%	12⅞ — 13½	12⅞ — 13½	12⅞	..	..	6 8 4
48,000	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 7 5
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	129 —134	129 —134	130½	129	..	5 4 6
2,000,000	Do. 5½ % Pref. Stock..	100	5½%	5½%	5½%	5½%	83 — 85	82 — 85	83½	82½	— ½	6 4 2
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	103½ —105½	103½ —105½	104½	..	..	3 17 8
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	11½ — 12	11½ — 11⅝	11½	11⅜	— ½	5 19 2
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
268,700	East & S. Afric. Tel., 4 % Mt. Db., 1 to 8,000, red. 1909	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
200,000	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	99½ —101½	99½ —101½	99⅞	..	..	3 18 10
181,127	Globe Telegraph and Trust	10	5%	5%	5%	5%	10½ — 10⅝	9⅞ — 10⅛	10⅛	9⅞	— ⅛	5 15 4
181,127	Do. do. 6 % Pref..	10	6 %	6 %	6 %	6 %	12⅝ — 13⅛	12⅝ — 13⅛	13⅛	..	..	4 9 9
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24 %	24%	20 %	20 %	30 — 32	30 — 32	31 5/8	..	..	6 5 0
14,800	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 7 5
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	55 — 56	52 — 55	54½	..	−2	6 16 4
$41,380,400	Mackay Companies Common	$100	1 %	2 %	3½%	4 %	76 — 80 xd	74 — 78	..	..	−2	5 2 7
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	70 — 73 xd	71 — 74	..	..	+1	5 12 8
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	4 %	5 %	6 %	6 %	⅝ — 1	⅝ — 1	..	..	..	6 0 0
86,492	Do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	3½ — 3¾	3½ — 3⅝	..	..	..	5 3 11
2,235,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	108½ —110½	108½ —110½	110	108½	..	5 8 7
8,725,000	Do. do. Def. Stock	100	5 %	5 %	5 %	6 %	116 —118	116½ —118½	117½	11 5/8	+ ½	5 1 3
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10½ — 11½	10½ — 11½	..	..	..	5 4 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	5 %	5 %	10½ — 11½	10½ — 11½	..	..	..	4 6 11
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 3/16 — 5 5/16	5 3/16 — 5 5/16	..	..	..	4 7 1
2,000,000	Do. do. 5½ % Deb. Stock Red.	Stock	3½%	5½%	5½%	5½%	98 —100	98 —100	..	..	..	3 10 4
1,716,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	101 —103	100½ —102½	101	..	— ½	3 18 1
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	6½%	7 %	7 %	8 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	5 16 4
50,000	Do. do. do. 6 % Cum. Pref.. ..	1	6 %	6 %	6 %	6 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	4 16 0
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	..	4 %	4 %	4 %	90 — 92	90 — 92	..	..	..	4 7 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 4
11,889	Reuter's	8	5 %	5 %	5 %	5 %	7 — 8	7 — 8	..	..	..	5 0 0
99,100	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	4½%	4½%	4½%	100½ —102½	100½ —102½	..	..	..	4 7 10
3,088	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	127 —130	127 —130	..	..	..	4 12 4
100,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅝ — 7⅛	6⅝ — 7⅛	..	..	..	5 16 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 10 11
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 58,008	2½	Nil	Nil	2½%	2½%	1¼ — 1⅜	1¼ — 1⅜	..	..	..	4 3 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	7 %	12⅝ — 13⅛	12¾ — 13	12 15/16	12½	— ⅛	5 7 8
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102 —104	102 —104	..	..	..	3 16 11
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
84,563	Do. do. 6 % Cum. 1st Pref.	10	6 %	5 %	8 %	6 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	7 7 8
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	£2 6	7¾ — 8⅛	7¾ — 8½	..	..	..	2 14 1
80,000	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

580,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,097	5	8 %	8 %	8 %	9 %	9⅛ — 9⅜	9⅛ — 9⅜	9 15/32	9¼	..	4 14 9
260,007	Do. 6 % Cum. Prefs., 1 to 260,007 ..	5	5½%	5½%	5½%	5⅔%	6⅝ — 6¾	6⅝ — 6¾	6 23/32	..	..	6 4 4
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	143 —148	143 —148	144½	143	..	4 2 2
295,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	102 —105	104½	104	..	4 15 3
580,000	Babcock & Wilcox, 1 to 580,000..	1	20 %	20 %	20 %	20 %	3½ — 4 1/16	3⅝ — 4	80/-	79/9	—1/6	5 0 0
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	5	6 %	6 %	6 %	6 %	1 15/16 — 1 31/32	1 15/16 — 1 31/32	29/6	..	..	8 13 10
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	1⅝ — 2⅛	1⅝ — 2⅛	..	..	..	15 11 2
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	3 — 3½	3 — 3½	..	..	..	10 0 0
40,000	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	7 1 2
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	3¾ — 4⅛	3¾ — 4⅛	..	..	..	4 8 11
43,473	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	105 —108	106 —108	..	..	..	4 12 7
800,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	..	5½%	5½%	98½ —100½	98½ —100½	..	..	..	5 9 5
400,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	6 %	8 %	134 —138	135 —138	137	..	+ 1	5 15 11
400,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	116 —120	116 —120	118½	..	..	4 11 4
800,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	107⅛ —109½	107⅛ —109½	..	..	..	4 11 9
223,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	10 15 5
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
133,301	British Electric Traction	10	6 %	3 %	Nil	Nil	⅛ — 1 3/16	⅛ — 1 3/16	21/3	..	..	Nil
161,497	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	8 %	3⅜ — 4⅛	3⅜ — 4⅛	77/6	75/-	..	7 1 2
1,473,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	92 — 97	92 — 97	93½	..	..	5 3 1
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	73 — 75	73 — 75	..	..	..	6 0 1
100,000	British Insulated and Helsby Cables	5	8 %	8 %	10 %	10 %	6½ — 7	6⅝ — 7	..	..	..	7 2 10
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6¼ — 6½	6¼ — 6½	..	..	..	4 12 4
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
208,440	British Thomson-Houston 4½ % 1st Mort. Debs.	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	4 13 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	⅜ — ½	⅜ — ½	..	..	..	Nil
1,016,353	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	43 — 48	43 — 48	46½	45½	..	8 6 8
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	⅞ — 1⅛	⅞ — 1⅛	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,731	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	2½%	Nil	Nil	..	..	..	..	..	Nil
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	Nil	Nil	..	..	..	..	..	Nil
125,000	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	65 — 70	65 — 70	..	..	..	6 8 7
125,000	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	49 — 53	49 — 53	..	..	..	8 9 10
127,610	Calcutta Trams, 1 to 127,610	5	8 %	8 %	8 %	6 %	4¼ — 5	4¼ — 5	..	..	..	6 0 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,330..	5	..	5 %	5 %	5 %	4½ — 5½	4½ — 5½	..	..	..	4 15 3
260,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
85,000	Callender's Cable Construction shares	5	12½%	15 %	15 %	15 %	9 — 10	9 — 10	..	..	..	7 10 0
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5¼ — 5⅝ xd	5¼ — 5⅝	..	..	..	4 8 11
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	107½ —109½	107½ —109½	..	..	..	4 2 2
491,222	Cape E Trams., 1 to 491,222	1	5 %	Nil	Nil	Nil	⅜ — ½	⅜ — ½	..	..	..	Nil
450,000	Casner-Kellner Alkali, 1 to 450,000	1	4 %	6 %	8 %	12 %	1⅛ — 1⅜	1⅛ — 1⅜	82/9	81/8	..	7 10 4
210,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4½%	103 —107	103 —107	..	..	..	4 6 11
1,898,610	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	3 %	64 — 66	64 — 66	..	..	..	4 10 11
558,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 — 86	84 — 86	..	..	..	4 13 0
558,195	Do. do. Def. do.	Stock	4 %	4 %	4 %	2 %	50 — 52	50 — 52	..	..	..	3 16 11
1,480,000	City and South London Railway	Stock	2⅜%	1⅞%	2⅜%	2⅜%	29 — 30	28 — 29	29½	28	— 1	7 6 7

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1904.	1905.	1906.	1907.	Closing Quotations Dec. 15th.	Closing Quotations Dec. 18th.	Business done week ended Dec. 18th, 1908. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
85,000	Crompton & Co., Nos. 1 to 85,000	8	2½%	2½%	5 %	5 %	1 5/16 — 1 1/8	1 5/16 — 1 1/8	..	..	..	10 0 0
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to £900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	98 —101	98 —101	..	..	..	4 19 0
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 3/32 — 1 5/32	1 3/32 — 1 5/32	..	..	..	7 2 10
305 000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	5 1 1
276,880	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
60,000	Dublin United Trams. (1896), 1 to 60,000	10	6 %	6%	6 %	6%	11½ — 12½	11½ — 12½	..	..	..	4 5 0
60,000	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	6 %	13 — 14	13 — 14	..	..	..	4 5 9
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	2¾%	4½%	4½%	4½%	1/4 — 3/8	1/8 — 1/4	8/3	..	— 1/16	16 15 3
17,189	Do. "A" shares, 01—017,189	5	2½%	4½%	4½%	4½%	1½ — 2½	1½ — 2½	..	..	..	8 6 9
317,875	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	76 — 79	76 — 79	..	..	..	5 1 8
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	86 — 89	86 — 89	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	4 %	Nil	Nil	Nil	1/8 — 3/8	1/8 — 3/8	..	..	..	Nil
81,390	Do. do. 7 % Cum. Pref., 1 to 81,390	2	7 %	7 %	7 %	7 %	1 — 1¼	1 — 1¼	..	..	..	9 6 8
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	7½ — 7⅞	7½ — 7⅞	6 7/8	..	+ 1/16	6 9 0
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	83 — 87	83 — 87	84½	84¼	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	4 %	3½%	1/4 — 3/8	1/4 — 3/8	..	..	..	6 13 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10½ — 10⅝	10½ — 10⅝	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15%	15 %	15%	11½ — 12½	11½ — 12½	..	..	..	6 0 0
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5½	5 — 5½	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105 —107	105 — 107	..	..	..	4 4 1
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	5 %	10%	10 %	10 %	16⅝ — 17⅜	16⅝ — 17⅜	16⅜	..	..	8 1 7
87,500	†Liverpool Overhead Railway, Ord.	10	1¼%	Nil	Nil	½%	1 — 1¼	1 — 1¼	..	..	..	4 7 6
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½	..	..	..	11 2 3
600,070	London United Trams. (1901), 1 to 50,007	10	6 %	8 %	8 %	8 %	6¼ — 6⅝	6¼ — 6⅝	..	..	..	4 8 11
299,980	Do. do. 60,008 to 100,000	10	6 %	8 %	8 %	8 %	6¼ — 6⅝	6¼ — 6⅝	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	5 %	4½ — 5⅛	4½ — 5⅛	..	..	..	9 1 10
1,881,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	67 — 72	67 — 72	..	..	..	5 11 1
5,782,062	Metropolitan Consolidated	100	3 %	2¾%	1 %	½%	36 — 37	35 — 36	26	35½	—1	1 7 9
2,640,914	Do. Surplus Lands	100	2¾%	2¾%	2¾%	2¾%	67 — 69	67 — 69	..	..	..	3 19 9
8,235,000	Do. District	100	Nil	Nil	Nil	Nil	18½ — 18¾	18½ — 18¾	..	..	— 3/8	Nil
314,016	Metropolitan Electric Trams., Defd.	1	Nil	Nil	Nil	Nil	3/16 — 5/16	3/16 — 5/16	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	5/8 — 3/4	5/8 — 3/4	..	..	..	5 19 5
823,800	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	96	95	..	4 13 9
245,500	Potteries E. Tro.	1	5 %	4 %	4 %	4 %	1/4 — 3/8	1/4 — 3/8	..	..	..	8 0 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	3/4 — 1	3/4 — 1	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	90 — 93	90 — 93	..	..	..	4 14 9
87,850	Telegraph Construction and Maintenance	12	15 %	15 %	15 %	17½%	80½ — 82½	80½ — 82½	..	..	..	7 14 11
150,000‡	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101½ —103½	101½ —103½	..	..	..	3 17 8
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	..	93 — 94	93 — 94	93¾	93⅝	..	..
2,800,000	Do. do. 4½% Bonds	..	..	..	..	..	73 — 75	73 — 75	..	..	..	..
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	20 — 22	20 — 22	..	..	..	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	Nil	Nil	10 %	3/8 — 7/8	3/8 — 7/8	..	..	..	10 0 0
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	Nil	Nil	..	6 %	2 — 2½	2 — 2	..	..	..	10 8 8
246,404	Do. 4 % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	68 — 72	68 — 72	..	..	..	5 11 1

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	5	5½%	5½%	5½%	5½%	4⅜ — 4⅝	4⅜ — 4⅝	..	..	..	5 11 5
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	94 — 98	94 — 98	..	..	..	4 10
30,275	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10%	10 %	8½ — 9	8½ — 9	..	..	..	5 12 8
9,725	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	8 — 8½	8 — 8½	..	..	..	4 2 4
886,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 —101 xd	98 — 101	..	..	..	3 19 3
80,000	Charing Cross and Strand Electricity Supply	5	8 %	5 %	5 %	5 %	4⅜ — 4⅞	4⅜ — 4⅞	93/9	..	..	5 2 7
80,000	Do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	8⅞ — 4⅜	8⅞ — 4⅜	84/4½	..	..	5 16 2
445,786	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	97 — 99	98 —100	98⅝	98	+1	4 0 0
49,486	Chelsea Electricity Supply, Ord.	5	6 %	6 %	4½%	4½%	3⅝ — 4½	3⅝ — 4½	78/9	75/-	..	5 5 11
175,000‡	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅞ — 10⅝	10⅞ — 10⅝	10½	10 7/16	+ 1/8	5 11 8
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12½ — 13	12⅝ — 13	..	..	..	4 12 4
400,000‡	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	128 —125	123 —125	..	..	..	4 0 0
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	101½	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	£3 7 0	4 %	4 %	2 %	2½ — 3	2⅝ — 3	..	..	..	3 6 8
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	3½ — 4	3⅝ — 4	..	..	..	6 5 0
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	..	99 —101	99 —101	..	..	..	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4½%	5 %	5 %	5 %	8⅜ — 9⅛	8⅜ — 9⅛	9 3/16	..	..	5 8 1
50,026	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝ — 11⅛	10⅝ — 11⅛	..	..	..	5 6 8
400,000‡	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	107 —110	107 —110	..	..	..	4 1 10
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	4 %	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	3 %	Nil	1/8 — 3/8	1/8 — 3/8	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	62 — 65	62 — 65	..	..	..	6 18 6
$8,160,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	..	84 — 86	83 — 85	84½	83½	—1	..
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	5 4 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 — 100	97 —100	..	..	..	4 10 8
15,000	Hove, 1 to 15,000	5	8½%	9 %	9 %	8½%	6¼ — 6⅝	6⅜ — 6⅞	..	..	+ 1/16	6 8 4
$1,325,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	..	95 — 96	95 — 96	96	..	..	..
21,000	Kensington and Knightsbridge Electric Ord.	5	12 %	10 %	10 %	10 %	7⅞ — 8¼	7⅞ — 8¼	..	..	..	6 1 3
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 2 6
111,000	London Electric Supply Corporation, Limited, Ord.	3	3 %	4 %	4 %	2¾%	1⅜ — 1⅝	1⅜ — 1⅝	..	..	— 1/8	3 6 8
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	4⅜ — 5⅛	4⅜ — 5⅛	5 1/16	5	..	5 11 8
374,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4½%	4½%	89 — 93	89 — 93	..	..	..	4 16 9
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	10 %	8 %	6½%	5 — 5⅛	5 — 5⅛	..	..	..	5 18 2
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝ — 5⅛	4⅝ — 5⅛	..	..	..	4 7 10
220,000‡	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	107 —110	107 —110	..	..	..	4 1 10
248,000‡	Do. 5% Mort. Deben. Stock Redem.	Stock	5½%	5½%	5½%	5½%	85 — 88	85 — 88	..	..	..	4 2 4
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	86½ — 87½	87⅜ — 88⅜	88⅛	87⅜	+1½	5 12 8
$18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	..	76½ — 77½	76½ — 77½	77⅛	77	..	..
$1,500,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	..	103½ —105½	105 —107	106⅜	105½	+1½	..
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	..	89 — 90	89½ — 90½	90⅜	89½	+ ⅛	..
£50,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
87,500	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	8 %	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	7 16 1
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 10 11
10,852	Notting Hill Electric Lighting	10	7 %	7½%	7½%	7½%	11⅞ — 12⅜	11⅞ — 12⅜	..	..	..	5 17 8
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	7 %	6⅜ — 6⅝	6⅜ — 6⅝	..	..	+ ⅛	5 9 10
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	..	2½%	..	1⅝ — 1⅞	1⅝ — 1⅞	..	..	..	..
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6	6	6	6	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	..
194,684	Do. do. 5% Deb. Stk. Red.	100	5	5	5	..	100 — 103	100 —103	..	..	..	4 17 1
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	12½%	10 %	10 %	8⅝ — 9⅛	8⅝ — 9⅛	..	..	..	5 9 7
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	4 13 4
150,000‡	Do. do. 3½ % Deb. Stock Red.	100	3½%	3 %	3½%	3½%	87 — 91	87 — 91	..	..	..	3 16 11
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	Nil	Nil	3/16 — 5/16	3/16 — 5/16	..	..	..	Nil
46,700	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	68 — 72	68 — 72	..	..	..	5 11 1
65,000	South London Electricity Supply, Ord.	5	4 %	4 %	3 %	4 %	2⅝ — 3	2⅝ — 3	57/6	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	Nil	2½%	2½%	2½%	3/8 — 1/2	3/8 — 1/2	..	..	..	3 6 8
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅝ — 1⅞	1⅝ — 1⅞	28/-	..	..	5 16 8
200,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	7/8 — 1	7/8 — 1	..	..	..	20 0 0
60,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1⅞ — 2	1⅞ — 2	..	..	..	12 10 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	80 — 83	80 — 83	..	..	..	5 8 5
600,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	..	7/16 — 15/16	7/16 — 15/16	..	..	..	..
110,000	Westminster Electric Supply, Ord.	5	14 %	18 %	12 %	10 %	8⅛ — 8⅜	8⅛ — 8⅜	8 3/8	..	..	5 12 8
81,379	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	5 %	4½%	4½%	5 — 5⅛	5 — 5⅛	5 3/16	..	..	4 8 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. ‡ Interim Dividend.

Bank rate of Discount 2½ per cent., May 28th, 1908.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING NOVEMBER, 1908.

Last month we referred to the pending inclusion of telegraphic cable and material in the export section of this return. Readers will notice that this is now included, and that certain rearrangements have been made in the table with a view to showing clearly the respective values of our telephonic and telegraphic business, so far as can be ascertained from the official returns.

Needless to add, the inclusion of telegraphic material in the export section, greatly increases the total value of the foreign and colonial business, which is, however, comparable with previous returns, by deducting the total of the "telegraph" column.

Thus, the export business for November amounted in value to £336,100, an amount including £121,723 worth of telegraphic cable and apparatus.

Excluding the latter amount, the total was £214,377, which compares with £294,753 in October, and thus shows a considerable reduction.

As regards the import returns, which have always included telegraphic material, the November total was £144,213, which compares with £149,375 in the previous month; the re-exports at £11,555 were some £400 to the good on the month.

Of the individual items, our export of electrical machinery shows a fall of approximately £60,000 in value during the month, and other items are somewhat lower; Spain was a customer to the extent of £99,000 worth of telegraphic material, which, of course, materially influenced the month's total; telephonic exports during the month amounted to £17,154, and it must be noted that this includes cable, previously included under the "cable" heading, and therefore explains to some extent the reduced total of the latter column, in both the export and import sections.

As regards the import section, the £50,000 worth of lamps, &c., is a striking feature: it will be noted that telephonic and telegraphic cable and material are lumped together, owing to this method being adopted in the official returns.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Country receiving exports and importing.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	53	250	99	156	806	3,354	6	25	...	97	110	4,956
Germany	472	3,710	...	33	73	279	...	36	...	...	...	4,603
Netherlands	364	526	76	...	...	270	...	4	...	...	...	1,240
Belgium	19	318	45	...	185	533	...	...	...	552	262	1,914
France	111	3,243	220	1,759	140	3,878	...	2	...	348	883	10,584
Portugal, Madeira, Portuguese Africa & Azores	383	972	38	...	...	1,817	...	502	...	19	686	4,417
Spain and Canary Isles	60	82	22	101	...	1,040	7	43	...	...	98,930	100,285
Italy and Austria-Hungary	146	55	133	61	725	2,391	...	65	...	...	...	3,576
Greece, Roumania and Turkey...	19	...	...	...	...	300	...	26	...	149	...	494
Channel Isles, Gibraltar, Cyprus and Malta ...	20	24	8	27	...	553	...	60	...	7	4,948	5,647
U.S.A., Porto Rica and Cuba	128	...	104	25	75	545	...	...	...	54	527	1,458
Canada and Newfoundland	105	1,487	10	236	45	890	...	30	...	30	4,379	7,212
British West Indies and British Guiana ...	3	22	103	15	14	59	...	18	11	39	53	337
Mexico, Colombia, Ecuador, Costa Rica and Panama	...	220	...	81	9	5,426	...	...	...	...	35	5,771
Peru and Uruguay	153	3,156	80	38	4	1,888	16	...	...	42	214	5,591
Chile	40	105	82	50	27	1,132	...	41	...	125	2,221	3,823
Brazil	695	1,744	412	587	19	9,948	...	16	...	...	695	14,116
Argentine	3,310	6,354	201	412	54	8,847	100	620	95	8,991	2,696	31,680
Egypt and Tunis	321	338	23	71	4	1,856	29	...	...	123	103	2,868
British West Africa	39	50	111	29	834	870	...	8	...	78	29	2,048
Cape of Good Hope	316	328	467	272	41	1,101	16	851	33	1,017	51	4,493
Natal	872	2,870	47	498	220	4,238	196	681	52	134	44	9,852
Zanzibar, British East Africa, Mauritius, Seychelles and Aden	112	39	9	98	...	248	...	4	...	121	247	878
China and Siam	660	397	351	824	563	399	...	...	...	140	114	3,448
Japan	228	2,872	124	194	1,132	14,756	6	...	10	2,670	386	22,372
Java and Dutch Indies	47	...	...	...	...	15	...	...	...	...	...	62
India { Bombay	689	1,258	892	190	320	3,300	405	1,015	46	328	393	8,836
India { Madras	181	556	98	29	...	6,309	...	12	...	12	211	7,408
India { Bengal	468	2,611	722	618	840	4,583	711	98	279	84	672	11,686
Burmah	68	512	172	30	...	545	...	...	...	91	...	1,418
Ceylon	44	169	164	18	...	710	...	25	...	81	82	1,293
Straits Settlements and Fed. Malay States ...	83	526	3	28	27	2,672	12	80	...	74	102	3,607
Hong Kong	293	...	40	...	...	2,202	116	15	...	...	...	2,666
West Australia	201	56	...	142	...	354	17	1,495	14	12	87	2,378
South Australia	427	617	220	15	...	4,313	6	148	...	1,204	202	7,152
Victoria	1,423	3,148	35	392	96	1,339	4	131	11	80	2,241	8,900
New South Wales	2,886	2,893	145	1,555	133	6,879	38	4,649	...	125	11	19,314
Queensland	...	524	8	...	27	73	...	31	...	...	...	663
Tasmania	10	...	...	...	...	...	...	...	...			10
New Zealand	1,329	103	204	531	910	2,706	3	816	...	327	115	7,044
Total, £	16,778	42,135	5,468	9,115	7,323	102,618	1,688	11,547	551	17,154	121723	336,100

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

	£	£	£	£	£	£	£	£	£	£	£
Norway, Sweden and Denmark	6	...	...	117	...	410	20	334	92	£6,109	7,088
Germany	1,066	2,352	480	36,809	...	9,313	4	1,161	3,214	6,440	60,839
Holland	68	1,969	320	6,536	2,434	2,786	...	610	5,499	1,022	21,244
Belgium	1,185	5,445	1,424	3,106	164	8,363	15	318	1,188	9,524	30,732
France	6	272	245	2,446	411	510	...	2,751	2,214	934	9,789
United States	2,510	55	686	213	...	8,661	1,663	210	53	420	14,471
Total, £	4,841	10,093	3,155	49,227	3,009	30,043	1,702	5,384	12,260	£24,449	144,163

Additional Imports: India (Bombay), electrical machinery, £50.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	£	£	£	£	£	£	£	£	£	£	£
Various countries, mainly as above	3,001	897	...	2,376	...	1,220	...	235	446	£3,380	...

Total Exports: £336,100. Total Re-Exports: £11,555. Total Imports: £144,213.

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

SOME ITEMS OF DRAWING-OFFICE SYSTEM.

By W. LAWRENCE.

The draughtsman is not a producer, and the expense of all work in the drawing office must go to augment establishment charges. For this reason it is essential that due attention be paid to drawing-office system, with the object of attaining the efficiency that is indispensable to economical working. In this, as well as in all other branches of organisation, previous experience with various systems cannot fail to be of assistance in attaining the best efficiency, and it is the ability to differentiate between systems which save work, and those which make it, that ensures the success of the system organised.

In the following an attempt is made to suggest some items of drawing-office system which have been found to save time in the drawing office (and often out of it, for that matter). To many readers some of the suggestions will be absurdly elementary, but there now exist drawing offices where even such elementary notions are unknown, or at any rate unpractised, and where chaos is the rule and efficiency ignored.

Size of Paper.—All drawings should be made to definite standard sizes. Drawing paper, tracing paper and cloth can be obtained in various widths ; 28 in. is a convenient size, and a piece 40 in. long can be accommodated on an ordinary sized drawing board. These limits form a conveniently sized drawing, big enough for general purposes. Half an inch is allowed as margin and a border line of 27 in. × 39 in. is obtained. By a process of successively halving the following sizes are arrived at ; the dimensions are those of border lines, half an inch margin being allowed in all cases : 19 in. × 27 in., 13 in. × 19 in., 9 in × 13 in. These limits should be rigidly conformed to, and should a drawing be too large for one size, the next larger should be used, and not a special size created to accommodate the drawing. The sheets might well be distinguished as A, B, C and D sizes respectively, commencing with the 27 in. × 39 in. sheet. This reference will assist in filing. Should anything larger than 27 in. × 39 in. be found necessary, the sheet should

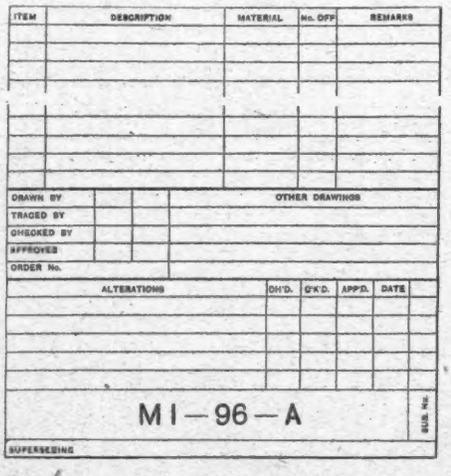


Fig. 1.

be made to suit the job, preferably not departing from the 27-in. dimension, and referred to as, say, X sheets.

Sketches.—These are always more or less difficult, nicely to deal with. The book and carbon-paper method is unwieldy, and the hectograph ink method is messy. Sketches should be made in pencil on tracing paper—dimensions and arrow heads being inserted in ink—and the D size sheet should be adhered to. If many copies are required, blue prints can be taken ; if only one or two, carbon papers can be used. A draughtsman can always work more quickly with squares on the board than in a book.

Tracings.—Standard tracings should be made in black Indian ink on cloth, and care should be exercised to have the drawings properly arranged. Much time can be saved by making drawings for special jobs on tracing paper, and printing direct from the pencil. Dimensions, however, and arrow-heads should be inserted in ink, to ensure their being distinct on the blue print.

Drawings.—Paper used for drawing purposes should be of very ordinary quality. It is absurd to use anything approaching the Whatman quality, eventually to be consigned to the waste-paper basket. The "coupon" or "detail" variety answers the purpose well, and with thick pencil a print can be taken from this if necessary. In assembly drawings a scale should be chosen that will give a clear and distinct drawing, avoiding, however, such scales as 4½ in. to the foot. Adhere to 1½ in., 3 in. and 6 in. to the foot, and full size ; 1½ in. to the foot is a convenient scale for switchboard work, and might be exclusively used independent of the size of the board. In detail drawings, wherever it is possible, full-size scale should be used. The same method of projection should be adopted by all draughtsmen, preferably that method which projects on to the right-hand side of the front view, the view looking in at the left. Details should be arranged and marked intelligently. Arrange small details as far as possible in rows across the paper, allowing ample space. There is much to be said in favour of the system of dividing up the drawing paper into regular divisions and putting details therein. Details such as standard screws and bolts need not be drawn out. Drawings should be clear and accurate, without any fancy work ; they are intended for works use, and not for a technical school exhibition. It is a waste of time to use colours, each class of material being indicated in print on the drawing. Section lines might well be simple, straight, uniform lines for all materials, as they need have no indicative meaning as far as material is concerned. Machining marks should be made on the tracing ; the practice of lining the blue prints with red crayon is expensive and uncertain. The drawing number

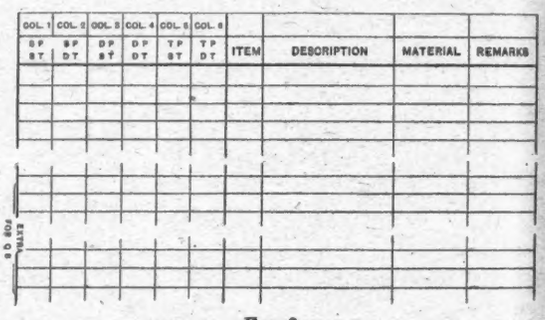


Fig. 2.

and title should be stencilled in plain block letters. A table should be provided on the drawing wherein such information can be put as is frequently referred to. Fig. 1 indicates such a table. Columns are provided for the list of material, every part of which should be recorded whether detailed or not. Screws, bolts, &c., can be inserted in these columns without being detailed. Suitable spaces are provided for recording the numbers of other drawings on the same job, for the order number and for any alterations made subsequent to the drawings being issued to the shops. Every alteration should be recorded in the space provided. If the alteration can be clearly indicated in a few words, these should be inserted and a new sub-number given. In the case of alteration to design, a print should be taken previous to alteration and the print filed, a note to that effect being inserted on the changed tracing. Of course, shop prints should be immediately recalled and brought up to date or cancelled and new copies issued. A standard drawing should be made for such things as switchboard frames, all variable dimensions being indicated by letters, and corresponding dimensions for the particular job being given on the switchboard drawing. The practice of using the drawing for some special job as reference is slovenly.

In some cases an arrangement of material list similar to fig. 2 saves drawings and time in reference. In the case given, the different classes of switch vary mainly in number of parts, and not so much in design. The details for all classes should be drawn on one sheet, and the columns filled in to

suit the heading. Details such as cable eyes, which are used by all departments, should be drawn on sheets which are common to all departments, each adding new designs. This avoids a multiplicity of designs for the same article.

OBSOLETE
SUPERSEDED BY
DATE

Fig. 3.

Drawings might bear a note "Work to dimensions given; report errors." This is, to some extent, a preventative against the shops altering imaginary drawing-office errors. A drawing-office stamp, similar in design to fig. 3, should be provided for use on cancelled drawings.

Numbering.—This is a feature which claims particular attention; much depends upon it. It is useless simply to give new drawings numbers consecutively. In a short time large integrals are arrived at, and reference is almost impossible. The reference number on a drawing should, to some extent, indicate the nature of the drawing; at the same time, it is advisable to reduce the number of digits as much as possible, and this point should not be sacrificed in pursuance of the former. Letters should be prefixed to indicate the subject of the drawing, but these should be limited to two or three in number. A prefix such as M.R. might be used for all railway motor drawings, S.O. for oil-switch drawings, and so on. Following the number proper should be the sheet reference letter previously referred to, and following, again, when writing for reference, should be the latest sub-number. Thus, MI-96-A-2 would indicate some induction motor drawing on A size sheet, having twice been changed.

Filing.—From most points of view, the common drawer system of filing is best. The drawers should take not more than 80 to 100 tracings deep, and should be provided with a means for preventing the tracings curling up at the back. Certain drawers should be suitably divided to accommodate the smaller size sheets. When large and small sheets are filed away together, the small sheets invariably find their way to the back of the drawer, causing needless searching.

The drawers should be labelled to indicate the character of the drawings filed, the size of sheet and range of numbers.

There is a system in vogue where tracings are rolled up on sticks, and put into tubes. This is cumbersome and extravagant of space. Drawings and prints so filed are difficult for a draughtsman to handle.

The folding of tracings should never be resorted to.

Office Copies and Originals.—Tracings should be recognised as being of value, and should not be carelessly or unnecessarily used. To this end, office copies of all tracings, or at any rate, all those most frequently in use in the

DRG. No.	SH'T.	SUB. No.	TITLE	DATE	INI'LS.

Fig. 4.

drawing office, should be taken, and the originals preserved. Ordinary paper blue prints adequately fulfil the purpose of drawing-office use, and white prints or cloth prints are unnecessary.

It is advisable to follow this precaution of using only copies, as it is common in drawing offices where this is not observed, to find tracings of such things as standard framework or cable eyes, utterly unrecognisable and useless for printing from.

Drawing Number Books.—It is best for each department to have its own drawing book, and if the amount of work warrants it, any class of apparatus might be so provided. For instance, D.C. generators might be provided with a drawing number book, and similarly D.C. motors. Books containing more than one set of numbers should be suitably divided so as to facilitate reference.

A suitable heading for a drawing book for general work is shown in fig. 4. Sufficient space should be left at the head of the page to insert the disposition of a machine, order number, job or nature of apparatus and the index letter. The sub-numbers should be kept up to date as alterations are made.

In any case a special book should be provided for switchboard work, and headed as in fig. 5. Of course, the drawing book should have an index, and this should be kept strictly up to date.

An alternative method of arranging drawing numbers, but one the full advantages of which are derived only from use

DRG. No.	SH'T.	SUB. No.	TITLE	CUSTOMER	ORDER No.	DATE	INI'LS.

Fig. 5.

on machine work, is as follows. Each new machine is given a new number, and this is the index to all drawings for that machine. A reference to fig. 6, showing the arrangement of drawing number book, will make this clear. Thus, throughout the series, No. 1 is always the frame drawing, No. 2 the bedplate drawing, and so on; and a reference number, 240-G.-8-A., would indicate the armature winding drawing for D.C. generator No. 240. Knowing the machine

MACHINE No.	DISPOSITION:-	O/No.

DRG. No.	SH'T.	SUB. No.	TITLE	DATE	INI'LS.
1			FRAME		
2			BEDPLATE		
3			SOLEPLATE		
4			BEARINGS		
5			ARMATURE HUB		
6			ARMATURE END RINGS		
7			ARMATURE STAMPINGS		
8			ARMATURE WINDING		
9			POLE STAMPINGS		
10			POLE SHOE		
11			FIELD WINDING		
12			BALANCE RINGS		
13			BRUSH ROCKER		
14			BRUSH GEAR DETAILS		
15			BRUSH GEAR ASSEMBLY		
16			COMMUTATOR HUB AND END RINGS		
17			COMMUTATOR ASSEMBLY		
18			SHAFT		
19			SHIELDS		
20			TERMINAL BOARD		
21			BOLTS AND NUTS		
22					
23					
24					

Fig. 6.

number, it is easy to remember the individual drawing numbers for each detail and so obviate reference. With this class of work it is often possible to use only A size sheets, and so eliminate this letter in the reference number.

Pattern Numbers.—These should indicate the nature of the pattern as drawing numbers indicate the nature of the drawing, and similar index letters can be used. If M.S. are the index letters for stationary motor drawings, these might also be used for index letters for stationary motor patterns. Following the index should be the pattern number proper, and then an initial letter indicating the material, and following again the latest change.

Whenever a pattern is altered, the number should have a sub-number added, as in the case of drawings. Thus M.S.-78-G-1 would represent some stationary motor casting in gun-metal and once changed. To effect the change in the pattern, the drawing must have been altered and a record of the original drawing filed, this showing the original

pattern. Thus a continuous record is kept of the evolution of the design.

Pattern Number Books.—These should be similar books to those used for drawing numbers, and if the number of patterns under any index warrants it a separate book should be provided for this series. Books containing numbers under more than one index should be suitably divided for reference.

A suitable heading for the pattern book is given in fig. 7. The sub-numbers should be kept up to date, and the number of the original drawing should be given. The latest sub-number on this drawing will give the latest pattern, for if the pattern is changed the drawing must be changed.

Drawings Received and Drawings Dispatched. — Two books should be provided for these purposes, and can be of inferior quality, not being so frequently in commission. All drawings received should be given an office number, with index letters similar to those used for standard drawings. The heading for the book should be similar to fig. 8.

Drawings dispatched should be recorded in a book having a heading similar to fig. 9.

Drilling Templates. — Drawings of drilling templates should be made for all instruments and fittings used on switchboard panels, and a series of numbers given to these templates. The drawings should be made on D size sheets, and copies put into a paper-folder for use in

PATT. No.	M'TL.	SUB. No.	DRG. No.	TITLE	DATE	IN'TL.

Fig. 7.

the drawing office. Every new instrument or fitting used should have a drilling template made, giving the position and sizes of holes required to be drilled in panels and also two centre lines.

The template number is put against the instrument or

DRG. No.	DATE R'CD.	RECEIVED FROM	TITLE	ORDER No.	THEIR No.

Fig. 8.

fitting on the switchboard front view drawing, and dimensions to the two centre lines are given.

Fig. 11 represents such a template.

Standard Data.—It is often a source of convenience to have in the drawing office a book of standard data. This can comprise anything to which frequent reference has to

DRG. No.	DISPATCHED TO	TITLE	ORDER No.	DATE

Fig. 9.

be made, and might include such things as particulars of stock sizes of bolts, set screws, &c., dimensions of any details frequently in use, such as cable-eyes, sections and lengths of standard commutator segments and so on.

Each set of particulars should be put on to a D-size sheet, and prints from these bound into a folder similar to that used for the template book. Fig. 10 shows a typical sheet for this folder.

In the foregoing no attempt has been made to give a complete drawing-office system. This in many details depends so largely upon the character of the work dealt with, and is so linked up with the systems of other depart-

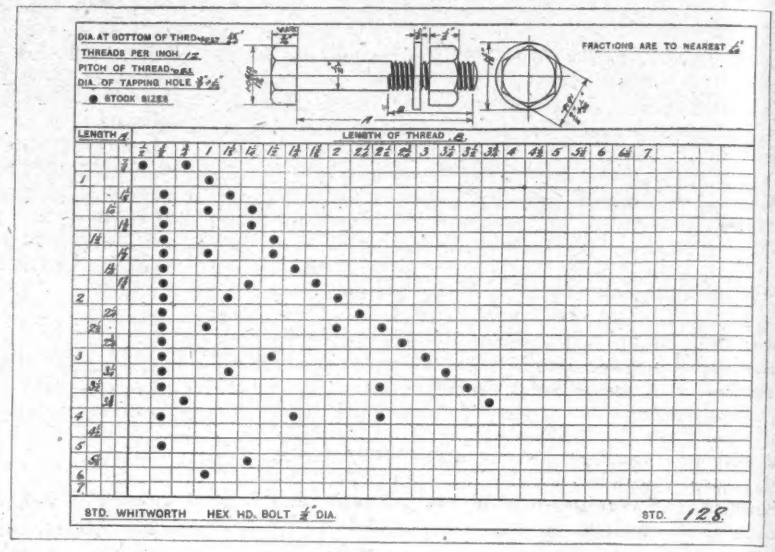


Fig. 10.

ments, that to deal with it completely would be beyond the limits of this article.

The items dealt with are all primarily connected with the inner working of the drawing office, and in the writer's experience have been found to conduce to that smooth running which

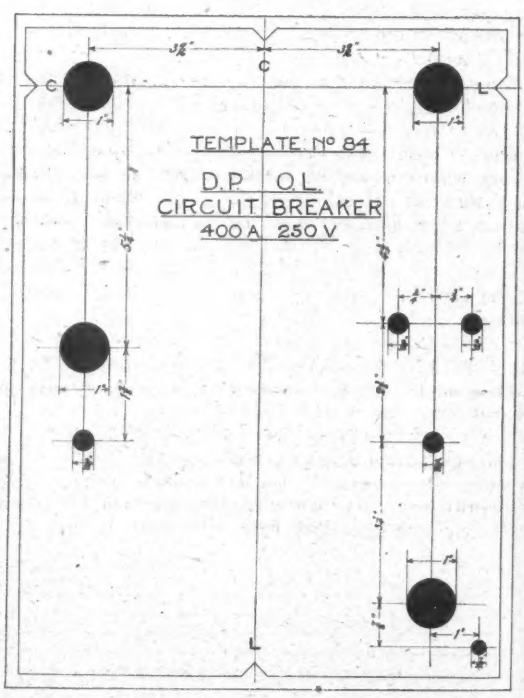


Fig. 11.

is inseparable from efficiency, and the absence of which leads to tedious working, mistakes and misunderstandings and their attendant expense both in and out of the drawing office.

Southend-on-Sea Electric Lighting.—The T.C. has reduced the price of electricity for motive power to 1d. per unit between 6 a.m. and 7 p.m., subject to consumers paying a fixed charge of £1 per quarter in lieu of meter rents.

THE LIGHTING OF READING ROOMS: WITH SOME EXAMPLES.

By P. BLAGG.

Of all the cases with which the illuminating engineer has to deal, it is probable that the lighting of reading rooms has been the source of most mistakes, for of no other class of buildings can it be said that more examples of bad, than of good, lighting are to be found. Whether the blame attaches more to the architect or the wiring contractor is immaterial, but in the result it is evident that, only too often, the fundamental idea—the idea that the reading matter, and not the the room in general, is to be lighted—has not been grasped.

In those cases in which expense has been a very secondary consideration, there is rarely anything to complain of, for a separate light has been provided for each reader. Examples of this may be seen at the United Service, and, indeed, at most West End clubs, where an "orchestra" light is fixed above each newspaper, throwing abundant light on the reading matter, whilst, at the same time, the actual lamp is concealed from the reader's eyes.

As applied to desk lighting a similar liberal allowance of "one man, one light" has been given in the British Museum Reading Room, where the general lighting of the room and dome is provided for by four or five large, open-type arcs, whilst each compartment of the reading desks is supplied with a pendant, cardboard-shaded lamp, connected by an ingenious plug attachment to a bracket arm. The light hangs about 2 ft. above the table, and the flexible which is provided between the plug and the lamp-holder, only an inch or so in length, minimises damage from any accidental blow to the shade. The lighting of the bookcases round the walls is effected by horizontal lamps with metal reflectors, fixed on the underside of the balcony to the tier of cases above, and entirely concealed from anyone in the centre of the room.

Though so liberal an allowance of points is not to be expected in every free library and reading room, both capital outlay and energy consumption having to be considered, still there is no reason why the same principle (of lighting the reading matter) should not be carried out. A few hundred pounds for architectural embellishments are not begrudged by municipal authorities as a rule, but the very small additional outlay and maintenance charges, which are necessary to make such institutions efficient in the hours of darkness, seem rarely forthcoming, or, when provided, are not applied with sufficient forethought.

Instances of badly arranged lighting are provided by the three libraries of so wealthy a body as the City of Westminster. Taking, first, the principal one in St. Martin's Lane, we find the basement Newspaper Room, in which artificial light is needed nearly all day long throughout the winter months, lighted by three-light "spider" pendants, about 7 ft. 6 in. from the floor, and arranged in lines down the centres of the passages between the stands. The result is that six distinct shadows of the reader's head appear on the pages of the week's Electrical Review, and of the greater number of other papers and magazines; eye strain and headache are the inevitable consequences of any prolonged study of the reading matter. For the stands round the walls a few brackets have been provided, and now (October) a move is being made in the way of fixing a "Linolite" lamp and reflector over each paper on these stands. This, indeed, is one of the most hopeful signs, as, at the present moment, not only here, but in many other places also, various experiments and alterations are in progress, mostly with a view to the utilisation of metallic-filament lamps, but all indicative of discontent with the present state of affairs. The Magazine Room upstairs is equally badly arranged, two-light ball fittings being hung, in nearly every case, over the centres of the gangways between the tables instead of over the tables themselves. Shadows are in consequence thrown upon the tables, and the reader must sit back in his chair and hold his book up in order to avoid them. The lighting of the Reference Room is considerably better, as the lights (three-light "spiders,") hang over the centres of the tables, but they might advantageously be dropped another 3 ft. lower.

The Great Smith Street branch attains a similarly bad effect by a different method. Three-light fittings having a 2 ft. spread, are fixed about 9 ft. above the floor. The papers on the stands round the walls are a mass of shadows, though, owing to the greater height of the lights these are not quite so distinct, and one side of the tables is similarly badly illuminated. The quantity of light seems ample if it were only applied in the best positions. In passing, it may be noted that, in common with many other reading rooms, this room, although lofty and spacious, has frequently a most objectionable atmosphere. Why this should be so is not apparent, for an exhausting fan is constantly running, so that it is evident the Committee has considered the matter. No doubt the loafers who habitually use free libraries are not always soap users, and electrical engineers should take this into account and turn their attention somewhat to the ventilation as well as the illumination of these rooms.

In the Buckingham Palace Road branch 5-light fittings, having a spread of 3 ft. at 9 ft. from the ground, are installed, and, in most cases, hang over the newspaper stands, on which the light is good. A few stands, on the other hand, and especially those round the walls, are very much troubled with shadows, one end wall only being provided with brackets (which light that end well). In the Magazine Room three-light pendants hang approximately over the tables and give a sufficient, though not a brilliant, light. They would be better if lowered somewhat or replaced by single higher candle-power lamps.

In contrast with the City of Westminster, the suburb of Acton sets an example of what may be done at a moderate cost, and is worthy of high commendation. Each side of each stand (about 10 ft. long and having three or four papers on) is provided with a single plain pendant, hanging about a foot in front of the centre of the stand at 6 ft. 6 in. from the floor. The stands round the walls, a weak point in so many reading rooms, have brackets and switches, in a corresponding position, every 10 ft. round the room. The result is a good light in every position. At present an experiment seems to be in progress with a view to utilising higher candle-power metallic-filament lamps, by drawing back one pendant to midway between two stands and abandoning the opposite lamp position. The effect is to cast a black shadow of the reader on to his paper, and it is to be hoped, therefore, that the attempt will not be persisted in. In this room those interested in antiquities will remark the old, sprawling, semi-ecclesiastical gas fittings still in position, although disused and dismantled. In the Magazine Room, the lights are brought well down over the centres of the tables, as they should be.

A similar arrangement of light for the newspaper stands has been adopted by the Royal Borough of Kensington in the old Town Hall. The lights over the tables, however, could be advantageously dropped to within 2 ft. 6 in. of the tables, with the addition of an opaque or green-backed shade.

Between these two praiseworthy specimens lie the three libraries of the Borough of Hammersmith. Of these, the Carnegie Free Library in Brook Green Road—architecturally as expensive a building, probably, as any library of its size in London—has hitherto provided a striking exhibition of how reading rooms ought *not* to be lighted. On entering the News Room, an idea of abundance of light prevailed. No doubt the quantity of light was at all times sufficient. But, oh, the shadows! The pendants had been arranged symmetrically on the ceiling, entirely regardless of what was to be placed below. The Magazine Room, equally with the News Room, was afflicted in this way, both in regard to the centre tables and the stands (at sitting height) round the walls. And to-day all that is altered! Not that perfection has been attained, nor that the shadows have been entirely eliminated, but they have been so far improved upon that reading is no longer a strain. This alteration has been brought about without rewiring or moving the positions of any points, merely by omitting certain lights, replacing others by high candle-power metallic-filament lamps, and *tying these up at* 14 *ft. from the floor*. Originally, each room had 20 two-light (16 c.p.) ball-pendants, and these have now been replaced by six 50-c.p., and three 100-c.p. lamps, with the result indicated. The Reference Room, though it may strike one as

gloomy and unlighted on entering, is, from the reader's point of view, efficiently lighted by a single metallic-filament lamp, hung low over each table.

At their Shepherd's Bush library also this council have recently rearranged the lighting, this time by adopting *low* candle-power metallic-filament lamps. These are fixed on brackets from the tops of the stands, holding the lamp about 1 ft. in front of the paper, and 7 ft. above the floor. The result is very satisfactory. This room, especially on a wet evening, presents another case for ventilation, the space being somewhat cramped.

The third example under this council is a converted private house in Ravenscourt Park. There are here no stands in the middle of the rooms, but only tables, all newspaper stands being round the walls. These latter are abundantly provided with brackets and switches, which the reader operates for himself. There seems no reason why current should not be more largely economised in this manner in reading rooms, as, although the reader usually forgets to switch off when he has finished, a commissionaire is generally in attendance at such institutions, who can turn unnecessary lights off as he walks round. A danger point is just being removed at this branch by the provision of a much needed hanging lamp on the fine old staircase. One also feels inclined to suggest to the Committee the advisability of fixing a lamp at the Park Gate.

The neighbouring Council of Chiswick has similarly converted a dwelling house into a library in Duke's Avenue. The lighting is fair, but is capable of improvement in one particular. Tables and wall-stands occupy the same room, and the pendants are hung from the correct points for each; but, as they are all at the same height, the table lights throw shadows of the readers on the newspaper stands. By simply lowering the lights over the tables, and providing them with opaque shades, the lighting of both stands and tables would be improved.

A provincial town provides an example of another satisfactory method. In the spacious Reading Room at Cardiff, where the newspaper stands are of an unusual height and massiveness, a two-arm standard fitting, having a spread of about 6 ft., rises from the top of the stand, and holds two 50-c.p. metallic-filament lamps in a line parallel, instead of transverse, to the centre line of the stand, and about 2 ft. above it. The broad tables are treated with similar standards and lamps, the latter at about 4 ft. above the table.

At Chelsea still another system has been adopted. The Reading Room is brilliantly, though not glaringly, lighted by abundant large Nernst lamps fixed about 9 ft. from the floor. For the most part the points are well placed in regard to both tables and stands, although, of course, certain of the papers are not absolutely shadowless. The Reference Room is also well lighted, one-light standards, about 2 ft. 6 in. high, being fixed in the centre line of the tables, and the general lighting of the room and the book cases being by means of three-light pendants.

We come then to the conclusion that the best method of lighting newspaper stands, short of providing a separate "orchestra" or "linolite" type of fitting for each paper, is to fix a 16-c.p. lamp, either by bracket or pendant, about 1 ft. in front of the centre line of the stand and 6 ft. 6 in. or 7 ft. from the ground—*i.e.*, usually about a foot above the top of the paper. Each such lamp to light not more than 5 ft. of stand in each direction, and to be provided for preference with a very shallow, dense or opaque shade. It should be borne in mind that a single 8-c.p. lamp, 1 ft. in front of the stand, is better for reading by than two 16-c.p. lamps, 3 ft. apart and 3 ft. from the stand. Further, the single 8-c.p. is better than the 8-c.p. *and* the two 16-c.p. lamps, because of the absence of shadows. It would, therefore, often be an improvement to cease to use certain points which were originally installed in some rooms for general lighting purposes, but the effect of which is mostly of a shadow-throwing description.

Alternatively these points should be shortened tight up to the ceiling, or, at any rate, not less than 14 ft. from the floor. Where stands are fixed round the walls, bracket lighting is almost essential. The only other system which will give even approximate satisfaction is to discard local lights and use high candle-power lamps, kept up as high as possible—at any rate, to 14 ft.—from the floor. It matters little from the lighting point of view whether metallic-filament, Nernst, or mercury vapour lamps are used, or, perhaps better still, inverted arcs.

In the Magazine Rooms the lamps should be brought to within 2 ft. or 2 ft. 6 in. of the table, either by standard fittings or pendants provided with either green-backed or opaque (metal or cardboard) shades. The alternative method of powerful lamps near the ceiling may also be used, but it is less desirable here than in the Newsroom, because a reader, bending over a book, would cast his shadow on the pages if the light were immediately over his head, a position which does not occur on the inclined newspaper stands.

It is possible that many troubles have been caused by inability to obtain definite information as to the future arrangement of furniture in the rooms whilst the building and installation were in progress. In other cases rearrangement of tables and stands may have upset what was originally a well thought-out scheme. Whether these or other matters have been the cause, there is no reason why the present state of things should be allowed to continue, and the subject is one deserving of more attention from electrical contractors and engineers than it appears to have received.

ELECTRIC FURNACE FOR THE PRODUCTION OF CARBON BISULPHIDE.

The uses of bisulphide of carbon are, perhaps, more various than is commonly known. It is a powerful insecticide, the vapour acting as an anæsthetic, and is hence found very valuable in killing pests of the field, shop, granary and household. The principal cause of destruction of grape vines—phylloxera—is destroyed by boring small holes in the ground about the vine roots, pouring in carbon bisulphide, and quickly closing the holes. Mice in mills and granaries may be killed by leaving vessels full of the liquid, so that the lower part of the room may be pervaded by the poisonous fumes. Moles and rats are exterminated by saturating balls of cotton, pressing them into the burrows, and closing quickly. The chief precaution to be taken in its use is that no fire or light should be brought into contact with the vapour; even a lighted cigar would cause a destructive fire.

The liquid is also used as a powerful solvent; it is used to dissolve out of olive pulp the oil which remains after pressing, and the product which is obtained is used for soap making. It is also a solvent for gutta-percha, forming cement which is largely used in the construction of rubber utensils. Wood fibre treated with a preparation of caustic soda and then with sulphide can be squirted through glass nozzles in the form of fine hair-like threads, which are then woven into an artificial silk.

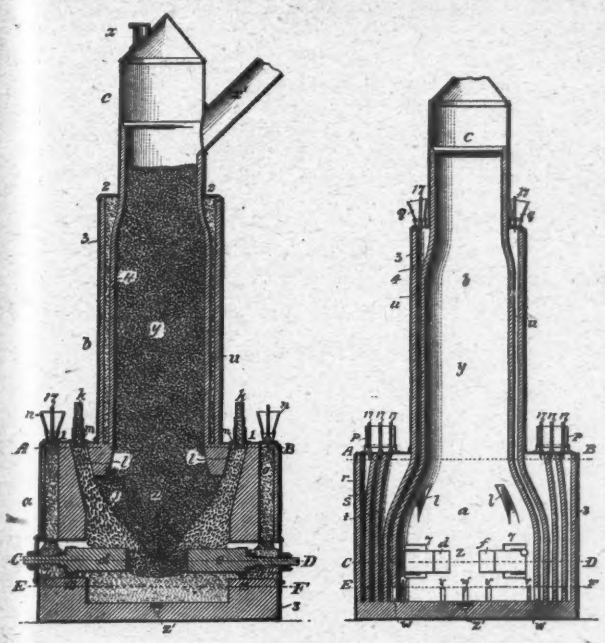
Discovered by Lamphidius in 1798, it was produced until recently in retorts heated externally by a coal fire or some other source of heat. In Sicily, in order to produce 10,000 lb. of carbon bisulphide in 24 hours, 48 retorts were required and a staff of 35 men to attend to them. After a few days these retorts had to be opened from the top and the ashes spooned out, and as sulphurous acid fumed up into the faces of the operators, the process was extremely disagreeable. The next step, as described by Mr. Ed. R. Taylor in a paper which he read before the Franklin Institute of Philadelphia, was the use of vertical retorts fired by coal. An opening at the base had every 10 days or two weeks to be utilised for the purpose of removing ashes, and as the retorts were extremely hot by that time the process was very disagreeable, besides losing about 12 hours at every cleaning.

Mr. Taylor therefore set to work to construct a more suitable form of retort, and he has been successful in developing the use of electricity in connection with this process, incidentally producing effects which mark one of the most probable means of progress in the utilisation of electricity for blast-furnace work. General views of the retort which is now used are shown in section in fig. 1, the view to the left-hand showing the appearance of the retort when full, while the right-hand view is a section at right angles showing the construction of the interior. Plans are also given of sections at lines A B, C D and E F respectively (fig. 2).

The furnace consists of a vertical stack, the central part of which is filled with charcoal; in the annular spaces round this central stack and at the base sulphur is fed in, while four electrodes connected in pairs to opposite poles of a two-phase alternating-current supply are placed immediately over the lowest part of the furnace. These electrodes are supplemented by a constant supply of small broken-up carbon fed in through hoppers, so as to pass round and towards the ends of the main electrodes, and this improvement constitutes a vital part of the successful operation of the furnace. In the first place it does away with the necessity of setting the main electrodes towards or from one another, thus securing an easy and permanent fixture of the entrance of current to the furnace. In the second place, wear of the expensive main electrodes is obviated by shielding them with easily replaced detached

granules of carbon, and in the third place the supply of broken carbons or coke affords an easy means of regulating the passage of current and gives a uniformity of action and temperature within the furnace, which is unobtainable by removable electrodes.

This is a distinct step in advance of most forms of electric furnaces, and a further advantage and economy is secured by the clever utilisation of the annular spaces round the main stack. These, as before mentioned, are filled with sulphur, and the heat of the arc is imparted to the vapours which rise through the central stack. In the majority of furnaces, beyond heavily lagging the



a, *b*, shell; *c*, cowl; *d*, *e*, *f*, *g*, electrodes; *h*, door; *k*, hoppers for *l*, broken carbon; *n*, *p*, *q*, hoppers for *o*, sulphur; *r*, *s*, *t*, *u*, annular channels; *v*, *w*, sulphur gates; *x*, x_1, vents; *y*, *z*, space for charcoal.

FIG. 1.—CARBON BISULPHIDE FURNACE IN SECTION.

surrounding shell, no provision would be made for absorbing this heat, and the greater portion of it would be lost. In the Taylor furnace, however, the heat of the rising gas in the central core tends to melt the sulphur in the outer annular spaces, as well as heating the charcoal in the central portion. The sulphur runs down, and by the time it reaches the arc is in a fluid condition. Moreover, the charcoal has been gradually raised in its passage downwards to an incandescent condition, so that the arc itself has no further work to do than the vaporising of the sulphur, which in this condition combines with the glowing carbon and forms vaporous carbon bisulphide. This passes off in the inclined pipe shown in the left-hand portion of the figure, and is condensed in suitable apparatus. Furthermore, it will be seen that the heat of the arc is, to a certain extent, its own regulator. Supposing that an extra

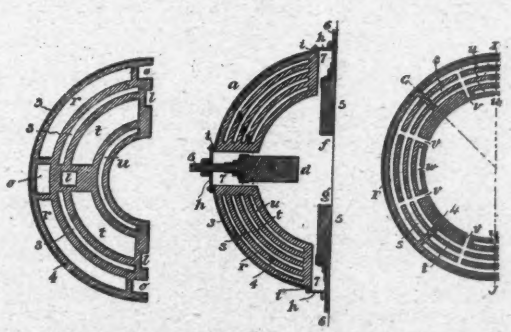


FIG. 2.—HORIZONTAL SECTIONS OF FURNACE.

burst of hot gas is generated, this will tend to make the sulphur in the annular spaces flow down more rapidly, the level of the pool of liquid sulphur will rise, and this, being an insulator, will cut off a portion of the available surface of the electrodes and automatically reduce the current passing. We have, therefore, an arrangement for bringing the raw materials gradually up to the required temperature by the utilisation of waste heat and an internal automatic arrangement for keeping the temperature of the furnace constant.

A plant for the manufacture of carbon bisulphide by this process was erected some time ago at Penn Yann, New York, and has been in steady operation for some years. The height of the two furnaces is 41 ft., and diameter 16 ft., and their construction on such a large scale removes at once the difficulty attendant on the operation of a battery of small retorts such as have hitherto been used in the manufacture. Incidentally, it illustrates the fact that electric furnaces are capable of being built on a very large commercial scale. The chief value of the furnaces is that they afford a continuous process. They are calculated to run for more than a year before the electrodes require renewal, or the furnaces cleaning out. The record run was 17 months, all but eight days. With the present facilities for obtaining electricity one furnace can produce 10,000 lb. of carbon bisulphide in 24 hours, the interior temperature being 1,000° to 1,500° F., and the temperature being maintained practically constant at any desired degree between these values; but if the furnace could be worked to its full capacity it could produce 25,000 lb. per 24 hours. The larger the production the more economical is the furnace, and the cooler the shell. At the rate of production of 14,000 lb. the highest temperature of the shell is 147° F., and it may be reasonably expected that, on a production of 25,000 lb. in the same furnace, the ideal condition may be closely approached of having the outer shell at a temperature little, if any, exceeding the temperature of the surrounding air.

It will be noticed that the two pairs of electrodes are placed at right angles to one another. Usually the passage of the current is directly across, but arrangements can be made to connect adjacent electrodes in the same phase; the value of this is that, should internal piers or obstructions be formed in the furnace, they can very easily be burned away by altering the passage of the current without the necessity of prodding the mass and disturbing the interior brickwork. As a result of this arrangement, it is found that, after several months' run, it is unnecessary to effect more than slight repairs to the brickwork, as there has been nothing in the steady running to displace the furnace lining.

Mr. Taylor obtains his current from water-driven plant, giving about 400 H.P. to two-phase alternators, which convey about 4,000 amperes of current at 60 volts to the furnaces. Each composite electrode in the furnace is composed of 25 carbons, each 4 in. × 4 in. × 48 in., making a complete electrode 20 in. square and 48 in. long; at the centre of the furnace they are about 12 in. apart. The covering of these ends by broken carbons breaks up and diffuses the current which, instead of forming one or two arcs, is broken up into a multitude of little ones, these disappearing as the furnace heats up. The action moderates the intensity of the heat and entirely stops the hissing of the current.

The market for carbon bisulphide is at present a limited one, and Mr. Taylor cannot sell all that he could possibly make with his furnace, so that no larger furnaces than those in use would be justified under the present conditions; but the results obtained with this apparatus are so good that were the market for carbon bisulphide as large and regular as the market for pig-iron, the size of the future furnace need only be limited by the market for the goods and the amount of electricity available. There seems no reason why any smelting operation should not be carried out in such a furnace.

The heat carried off by the waste gases is taken care of by the annular construction surrounding the central stack, and the same means of automatically regulating current either by the rate of flow of incoming material or by the supply of broken carbon to the electrodes might be applied to any such process. It would be a comparatively simple matter to make provision in the furnace to tap the slag or metal, either periodically or continuously, and the availability of electricity for such a purpose would be only dependent upon sufficiently cheap water or other power and economical conditions of labour. Mr. Taylor's furnaces prove that electric furnaces of this size are simple to manage, capable of giving continuous operation, and high efficiency of working, and when compared with the high capital cost required for the construction of blast furnaces it will be seen that considerable vigour should be put into an attempt to substitute electricity for the comparatively wasteful method of heating raw material by means of external sources of heat.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AUSTRALIAN COMMONWEALTH

(Includes Victoria, New South Wales, Queensland, West Australia, South Australia and Tasmania).

The Australian Tariff is divided into two sections—the General Tariff and the British Preferential Tariff. The British Preferential Tariff is applicable only to goods manufactured in the United Kingdom, the qualification for such goods being that at least 25 per cent. of the value must be produced by British labour. The rates given are those under the British Preferential Tariff where preferential rates exist. In order to secure entry under these preferential rates goods must be accompanied by a certificate written, printed or stamped on the back of the invoice, and the following form has been decided upon for such certificates:—

I, { manufacturer / the supplier } of the articles included in this invoice, have the means of knowing, and do hereby certify that the said invoice from myself to and amounting to is true and correct; and that all the articles included in the said invoice are *bona fide* the produce or the manufacture of the United Kingdom, and that a substantial portion of the labour of that country has entered into the production of every manufactured article included in the said

invoice to the extent in each article of not less than one-fourth of the value of every such article in its present condition ready for export to the Commonwealth of Australia.

Witness

Dated at , this day of 190 .

☞ When this certificate is signed by some person on behalf of a manufacturer or supplier, such person must state that he is duly authorised to do so, and it is essential that his signature should be witnessed.

The gross weight should be marked on packages and stated on invoices, and as far as practicable, the separate value of each package should be indicated. Where various descriptions of merchandise are packed together, a list of contents of each package should be furnished. As merchants' invoices have to be produced to the Customs officials, when entry is passed, it is important that invoices and bills of lading should be posted promptly.

	Ad. val.
Miner's safety lamps	free
Motive-power machinery and appliances (except electric):	
Flue-heated economisers, mechanical stokers, steam traps, steam turbines, superheaters, water purifiers	free
High-speed reciprocating steam engines for direct coupling or directly coupled to electric generators or to pumps, subject to Departmental by-laws	free
Other	20 %
Locomotives, traction and portable engines, steam road rollers, including scarifier attachments	20 %
Chain blocks and travelling blocks, pneumatic elevators and conveyors, rotary blowers for smelting, and turbo blowers, telphers, apparatus for liquefaction of gases, patent portable hoists for underground use	free
Log band saws with band wheels, 5 ft. and over in diameter	free
Machinery not separately mentioned in the tariff	20 %
Rotary and percussive rock drills and coal-cutting machines	free
Rock-boring machines not elsewhere mentioned	20 %
Electrical machines, appliances, and parts thereof:—	
Dynamo-electric machines up to the capacity of 200 H.P.; static transformers and induction coils for all purposes; electric fans	20 %
Dynamo-electric machines over the capacity of 200 H.P.	12½%
Regulating, starting and controlling apparatus for all electrical purposes, including distributing boards and switchboards, except telephone switchboards	20 %
Electric fittings consisting wholly or partly of metal, viz.:—Switches, fuses, and lightning arresters	free
Electric heating and cooking appliances	10 %
Electric fittings not containing metal to be dutiable according to material.	
Generators for direct coupling to steam turbines	free
Electrical and gas appliances, viz.:—	
(*a*) Electroliers; gasoliers; chandeliers; pendants; brackets; zinc tubing	20 %
(*b*) Gas meters	free
(*c*) Telephones, telephone switchboards and appliances	free
(*d*) N.E.I.	10 %
Electrical articles and materials, viz.:—	
Accumulators or storage batteries; arc lamps; arc lamp carbons; cable and wire (covered); carbon in blocks of 12 sq. in. and over, electric vacuum tubes; measuring and recording instruments; prepared insulating tape	free
Rails, fish plates, fish bolts, tie plates and rods, switches, points, crossings and intersections for railways and tramways	10 %
Rolled iron or steel beams, channels, joists, girders, columns, trough and bridge iron and steel, not drilled or further manufactured	12½%
Anodes, cathodes and hooks for plating purposes	free
Copper wire	free
Steel wheels of over 30 in. diameter in the tread, for trucks and wagons	free
Wire not separately mentioned	free
Glass cells for primary and secondary electric batteries	free
Leather, rubber and composition belting and green hide for belting and other purposes	20 %

Articles imported by the Commonwealth; scientific instruments and apparatus imported by and for use in Universities, colleges, schools, or public institutions; machinery for use in Universities or public educational institutions, free.

The value on which *ad valorem* duty is levied is the fair market value of the goods in the principal markets of the country whence the same were exported, in the usual and ordinary commercial acceptation of the term, free on board at the port of export in such country, with a further addition of 10 per cent. on such market value. The free on board value is to include cost of labour and materials used for packing, and all cost of conveying the goods from the place of sale and placing them on board the exporting ship.

East Cowes Electric Lighting.—The U.D.C. has requested the Water Committee to consider the advisability of installing an electrical plant at the waterworks.

NEW PATENTS APPLIED FOR, 1908.

Compiled expressly for this journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

26,420. "Improved detachable terminal for high and low-tension wires on motor vehicles." L. KIRBY. December 7th.

26,430. "Generator-motor or an electrical speed-reducing (or increasing) and reversing gear especially applicable to turbines used for marine propulsion." J. LECOCHE. December 7th.

26,441. "Trolley guards." S. G. WILCOX. December 7th.

26,449. "Improvements in hot-wire electric current measuring instruments." HARTMANN & BRAUN ACT.-GES. (Date applied for under Sec. 91 of the Act, March 6th, 1908, being date of application in Germany.) December 7th. (Complete.)

26,450. "Improvements in hot-wire electric current measuring instruments." HARTMANN & BRAUN ACT.-GES. (Date applied for under Sec. 91 of the Act, March 6th, 1908, being date of application in Germany.) December 7th. (Complete.)

26,453. "Method of emergency or secondary lighting for use in connection with electrical lighting installations." H. HALE. December 7th.

26,477. "Improvements in the mode of and means for purifying oily or greasy waters or steam and other fluids or liquids by electricity." E. PERRETT and R. B. PERRETT. December 7th.

26,485. "Improvements in and relating to trolley wire suspenders." J. MAYER. (Date applied for under Sec. 91 of the Act, December 21st, 1907, being date of application in United States.) December 7th. (Complete.)

26,502. "Improvements in electric shutter indicators." H. WANDREY. (Date applied for under Sec. 91 of the Act, December 7th 1907, being date of application in Germany.) December 7th. (Complete.)

26,507. "Improved means for conducting current to or from continuous-current electrical machines." J. A. JOHNSON and C. A. WALLEEN. December. 8th. (Complete.)

26,533. "Improvements on circuit-breaker action." C. A. WILD and H. LISTER. December 8th.

26,555. "Improvements relating to transformers for operating vapour electric devices." F. CONRAD. (Date applied for under Sec. 91 of the Act, January 10th, 1908, being date of application in United States.) December 8th. (Complete.)

26,572. "Improvements relating to electric lighting installations where high-voltage currents are transformed." L. G. WALKER. December 8th.

26,588. "Improvements in apparatus for measuring electro-magnetic wave lengths." MARCONI'S WIRELESS TELEGRAPH CO., LTD., and H. J. ROUND. December 8th.

26,592. "Portable heat-resisting electric lamp protector specially adapted for bakery ovens and other chambers of high temperatures." C. R. ELLINGER. December 8th.

26,620. "Automatic switching devices for flash advertising." L. K. JOB. December 8th.

26,630. "Rotary switch for turning on or off an electric light and the like." O. BAKER. December 9th.

26,665. "Improved method of driving a centrifugal pump blower or the like by means of a rotating field electric motor in such a manner that no glands or stuffing boxes are required." SIR H. NORMAN and T. B. READER. December 9th.

26,666. "Electrical converter for converting direct current to alternating current or *vice versâ*, and for transforming the voltage as required." SIR H. NORMAN and T. B. READER. December 9th.

26,674. "Improved means of charging several batteries in parallel, and also for regulating the voltage on electric feeders." W. A. STEVENS. December 9th.

26,687. "New or improved current limit indicator." T. H. THURBURN. December 9th.

26,709. "Improvements in and relating to current collectors suitable for electrically-propelled 'vehicles.'" S. Z. DE FERRANTI. December 9th. (Complete.)

26,752. "Improvements in electric lampholders." W. FENNELL and W. P. PERRY. December 10th.

26,796. "Improvements in mechanical connectors for electric cables." J. STRATTON and E. A. CLAREMONT. December 10th. (Complete.)

26,808. "Improvements in and relating to electrical condensers." M. MEIROWSKY. (Date applied for under Sec. 91 of the Act, May 18th, 1908, being date of application in Germany.) December 10th. (Complete.)

26,822. "Improvements in or connected with electrically heated geysers." H. J. READ. December 10th.

26,825. "Improvements relating to the production of coherent conductors of refractory material suitable for incandescent electric lamps and other purposes." BRITISH THOMSON-HOUSTON CO., LTD., and J. GRAY. December 10th.

26,832. "Improvements in instruments for detecting electric oscillations." J. A. FLEMING. December 10th.

26,836. "Improvements in electric traction contact boxes." T. H. BLAKE. (Application for Patent of Addition to No. 10,636/1907.) December 10th.

26,844. "Improvements in and relating to electrical conductors." K. BUCHLER. December 10th.

26,862. "Improvements relating to devices for steadying the load on connected generating plants." E. JACOB and THE TUDOR ACCUMULATOR CO., LTD. December 10th.

26,867. "Combined telephone and electric light or other equipment for use in connection with diving apparatus." R. H. DAVIS, E. A. GRAHAM and A. W. VOX. December 10th.

26,881. "Improvements in or connected with mechanisms for operating and controlling the movements of members, particularly adapted for use in the construction of electric switch mechanism." THE ELECTRIC CONTROL, LTD., C. MACMILLAN and G. RATTENBURY. December 11th.

26,894. "Improvements relating to electric ignition apparatus for internal combustion engines." A. W. BIRD and THOMSON-BENNETT, LTD. December 11th.

26,915. "Improved keyboard transmitter for printing telegraph systems." D. MURRAY. December 11th.

26,916. "Improved tape transmitter for multiplex telegraph systems." D. MURRAY. December 11th.

26,917. "Improved synchronising arrangements for a multiplex printing telegraph." D. MURRAY. December 11th.

26,918. "Improved printer for a multiplex printing telegraph system." D. MURRAY. December 11th.

26,929. "Improvements in or relating to cluster lampholders for electric incandescent lights." J. SAX & CO., LTD., and H. C. WHEAT. December 11th.

26,951. "Improvements in point and switch indicators for railways." G. WOLFSGRUBER and F. HOLLITZER. December 11th.

26,963. "Improvements in or relating to electrically-operated brushes for horses and other animals." F. P. HEATH. December 11th.

26,967. "New or improved time relay for electric currents." D. TIMAR and R. ZIEGLER. December 12th. (Complete.)

26,973. "Improvements in electrical contacts." G. HOOKHAM. December 12th.

26,984. "Improvements relating to dynamo-electric machines." J. P. HALL and G. A. ROBERTSON. December 12th.

27,020. "Improvements in or relating to magnetic separators." F. POWELL. December 12th.

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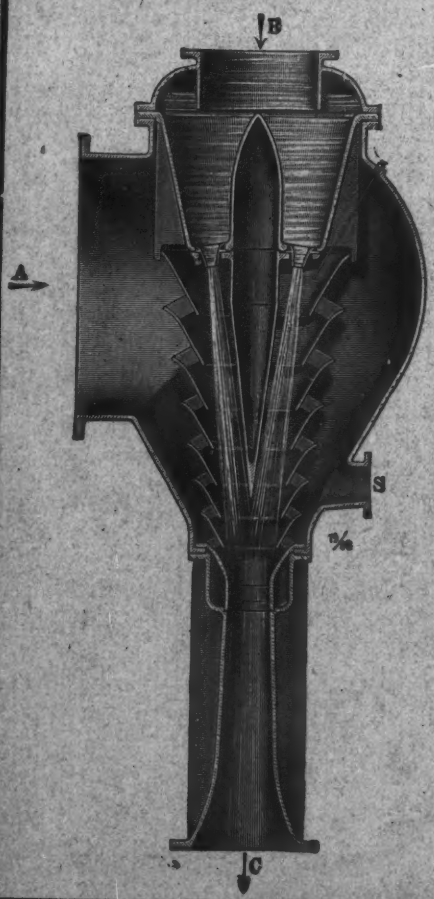

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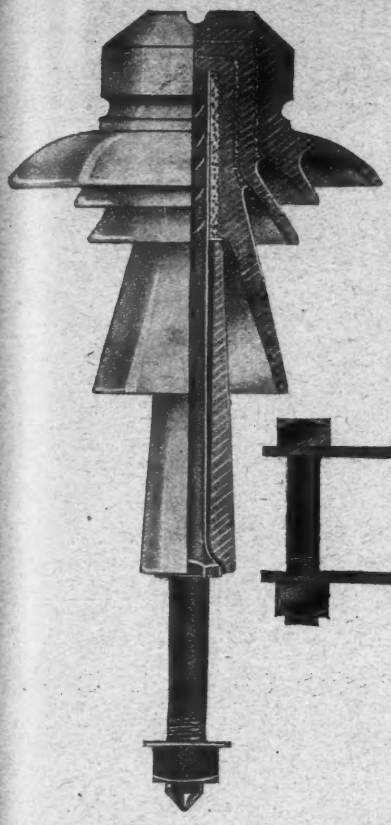

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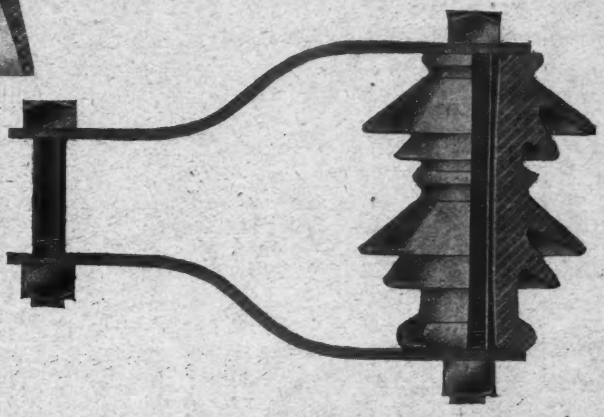

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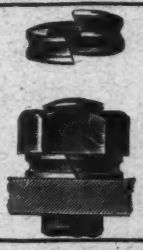

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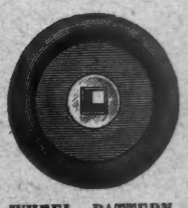

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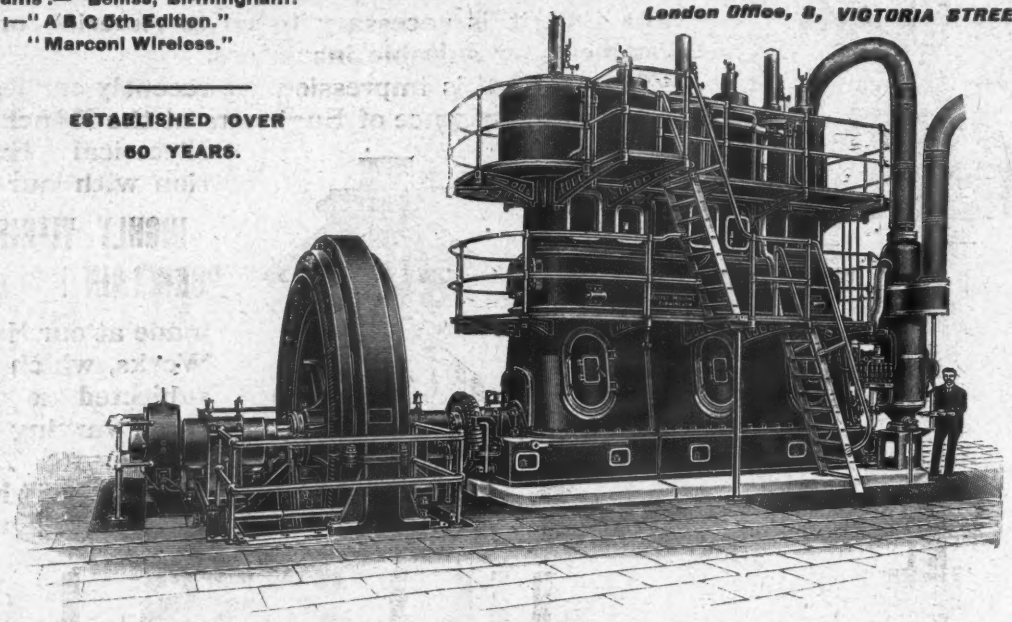

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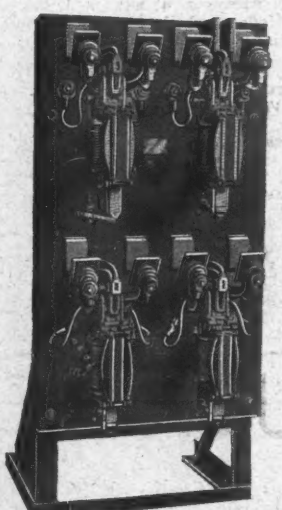

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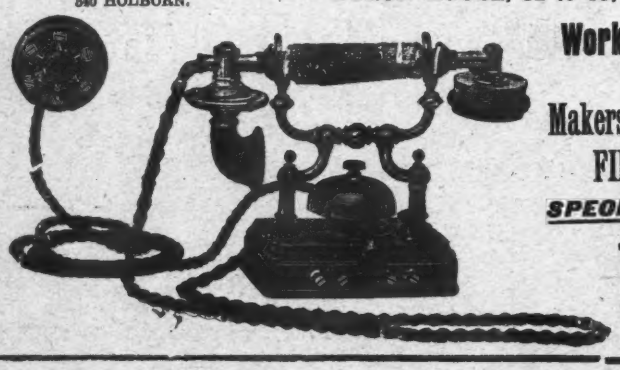

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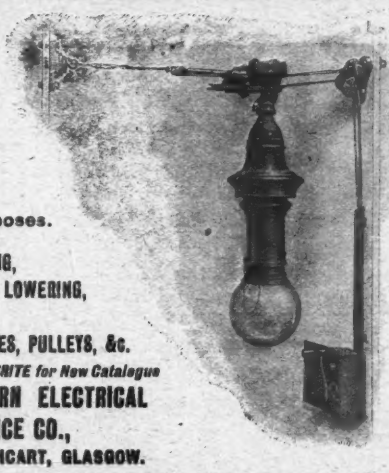

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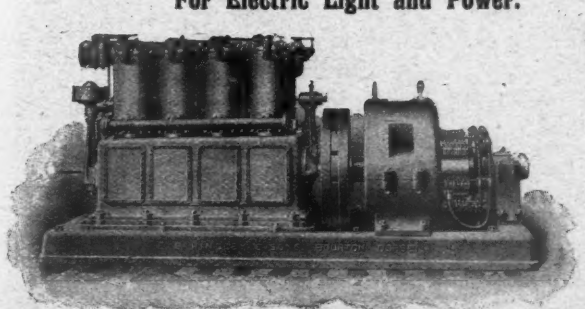

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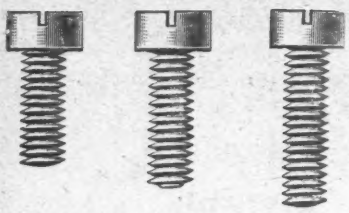

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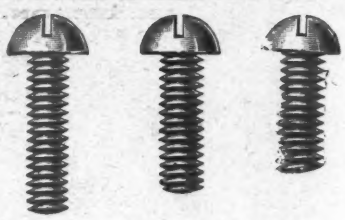

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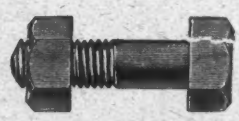

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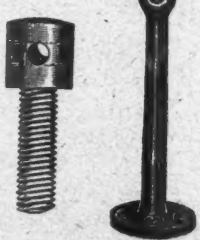

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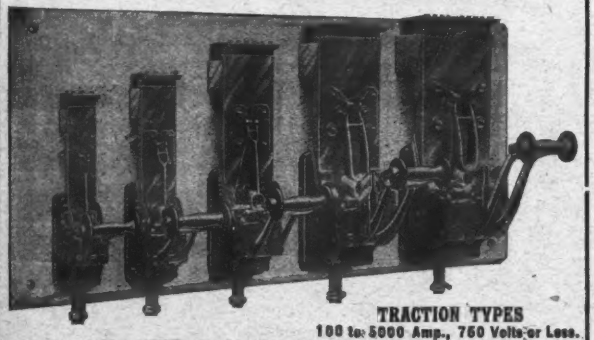

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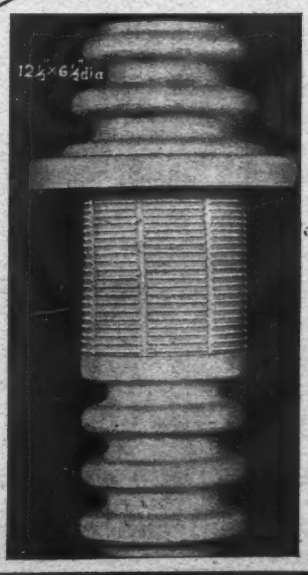

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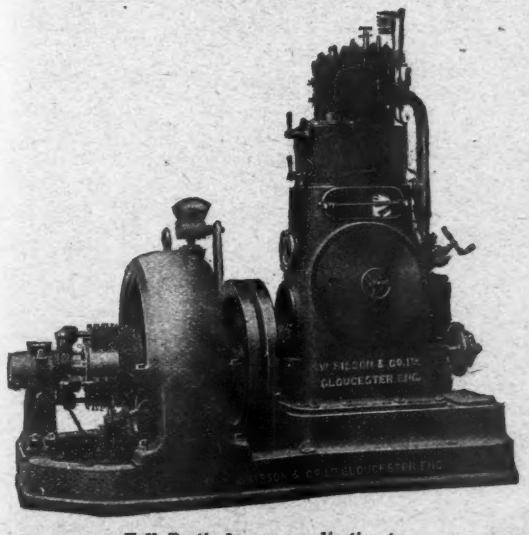

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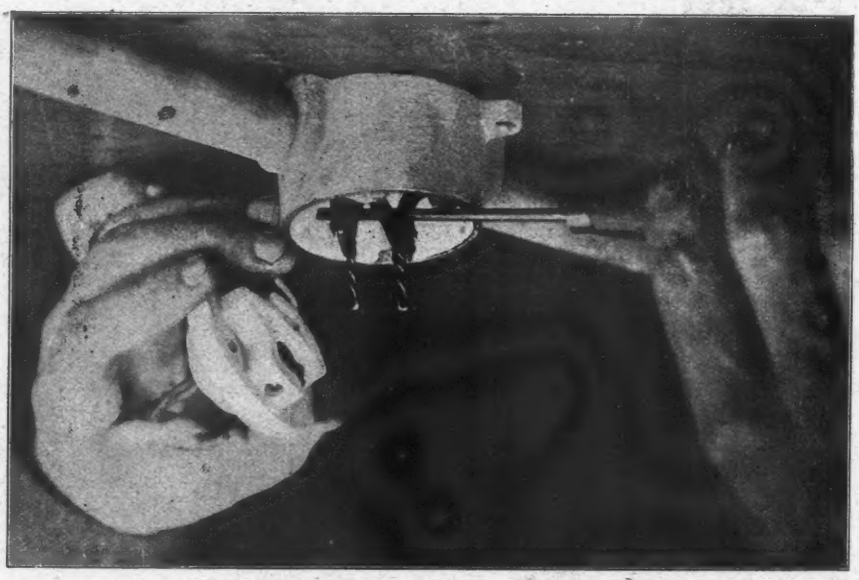

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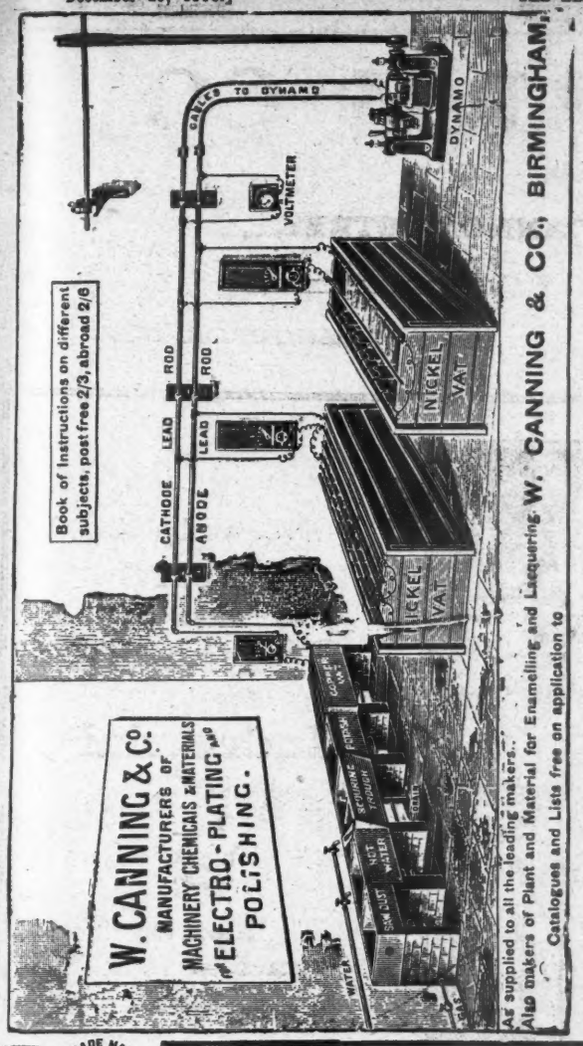

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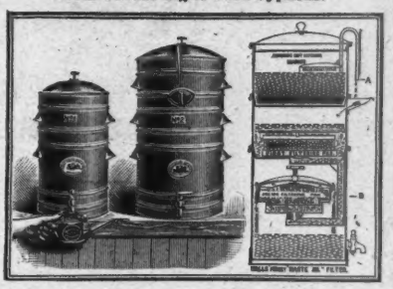

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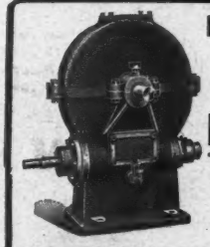

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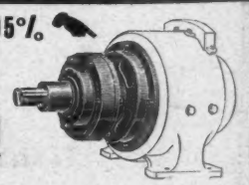

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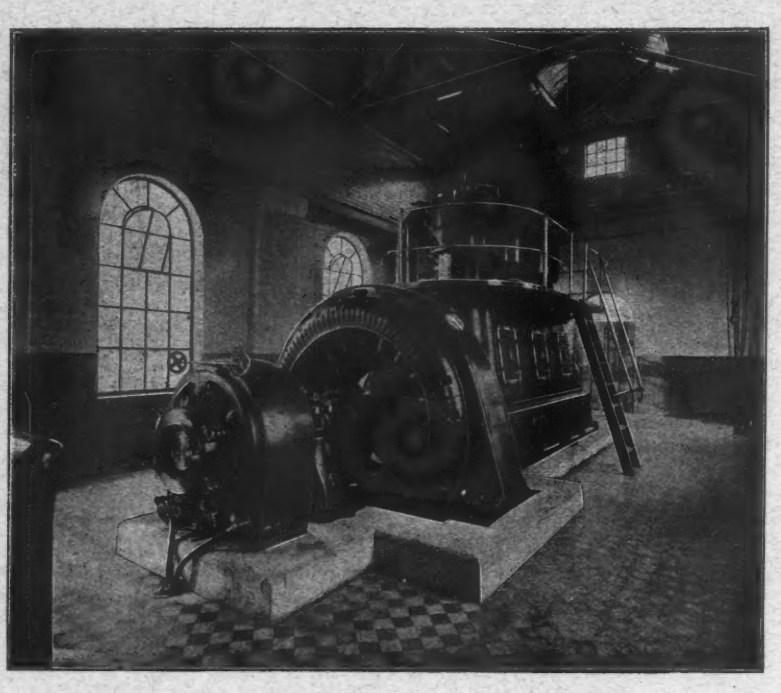

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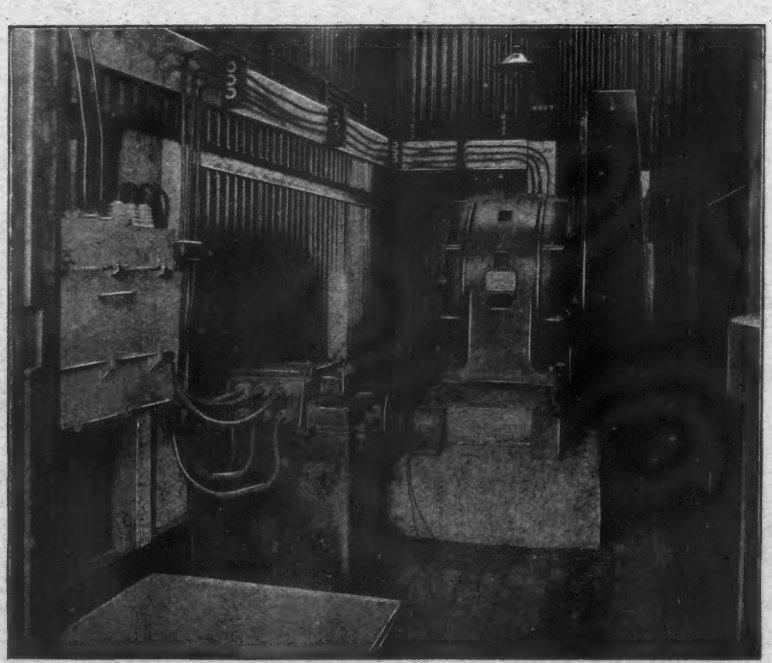

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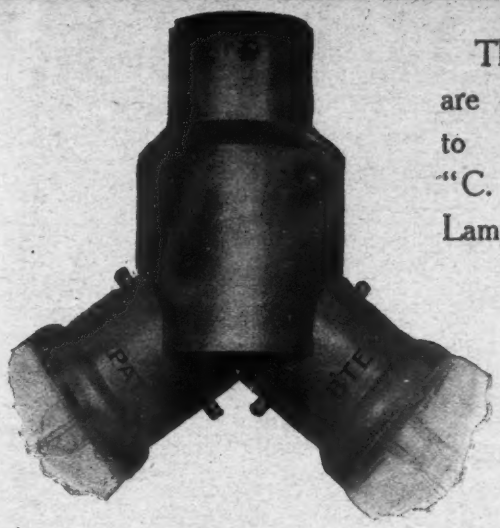

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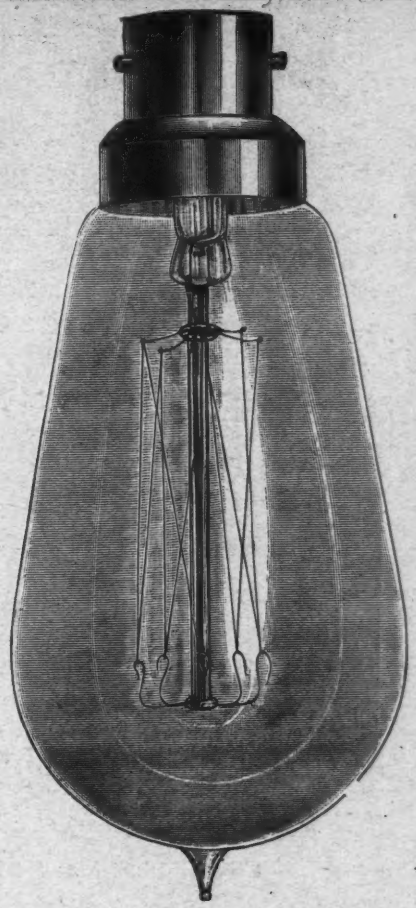

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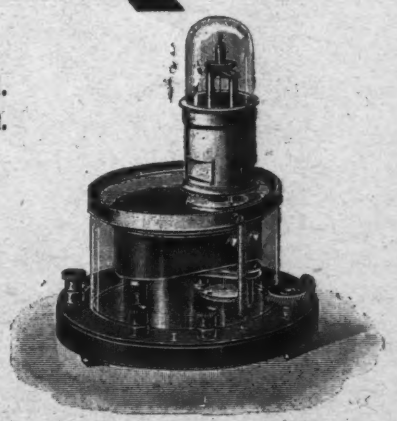

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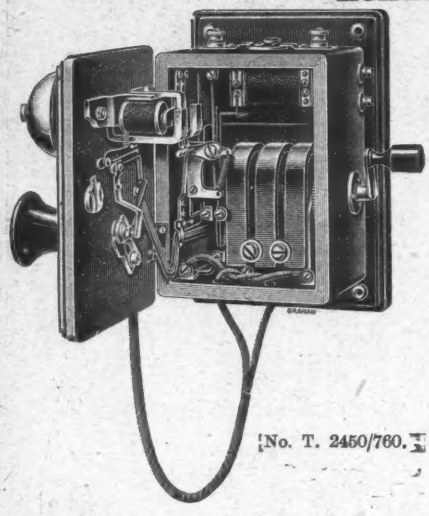

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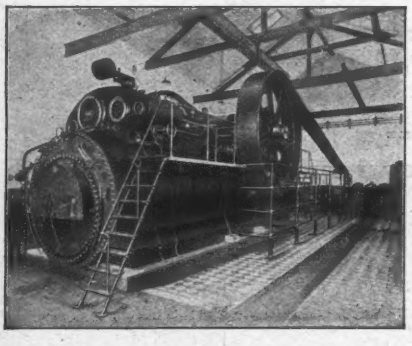

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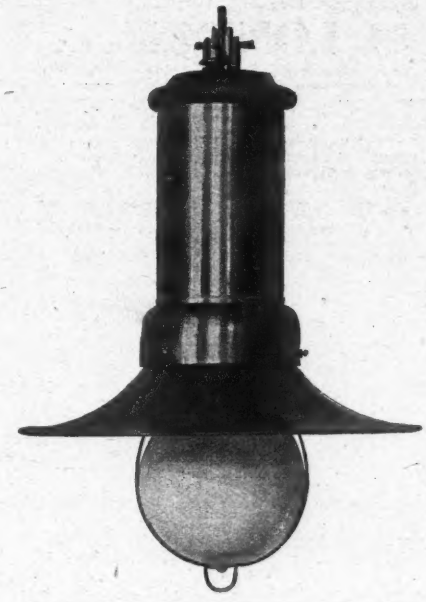

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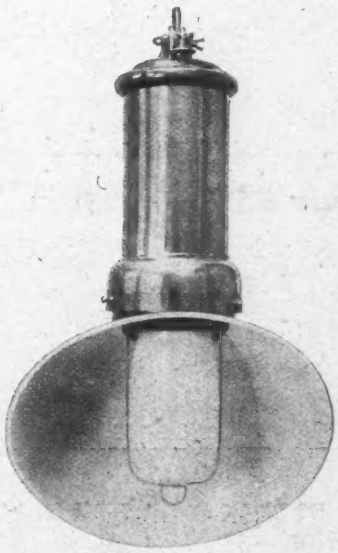

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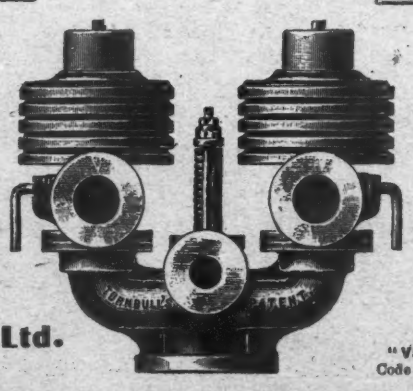

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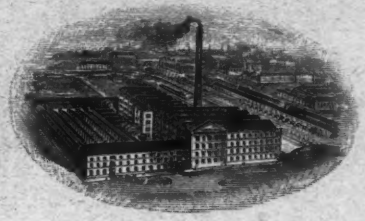

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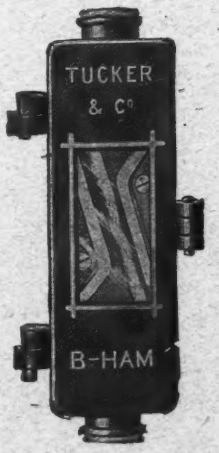

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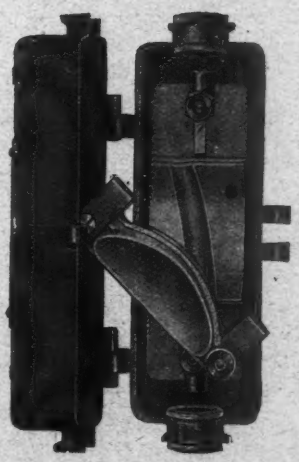

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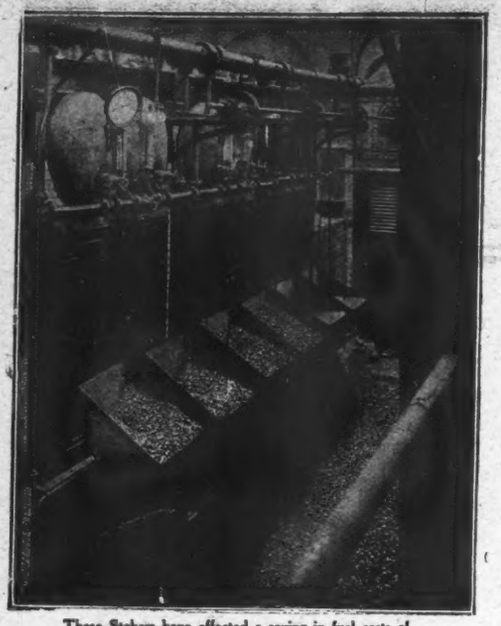

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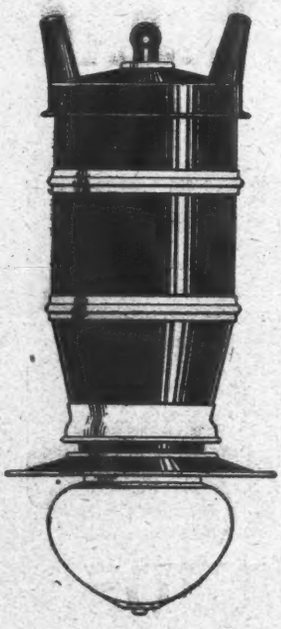

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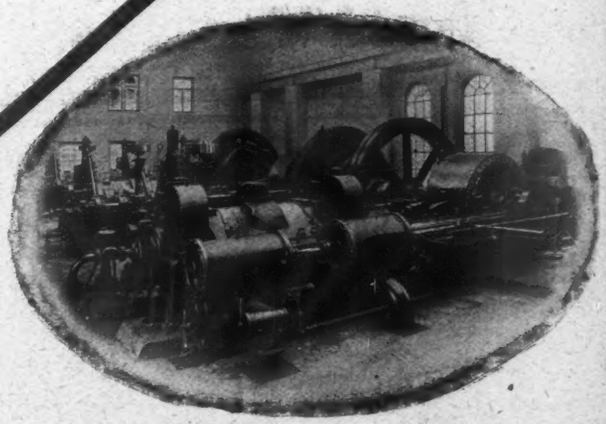

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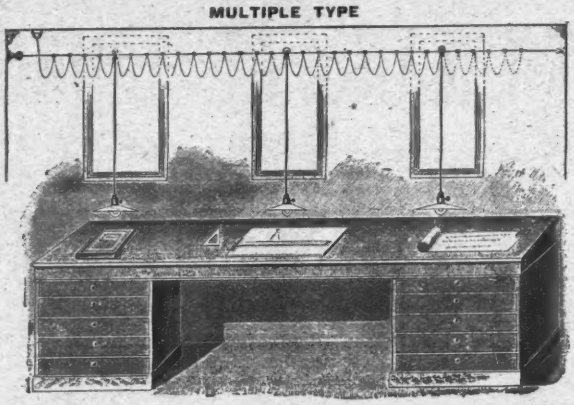

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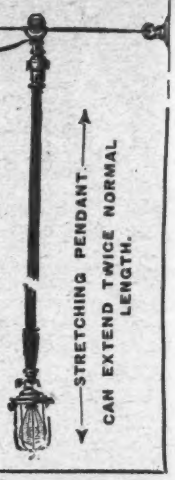

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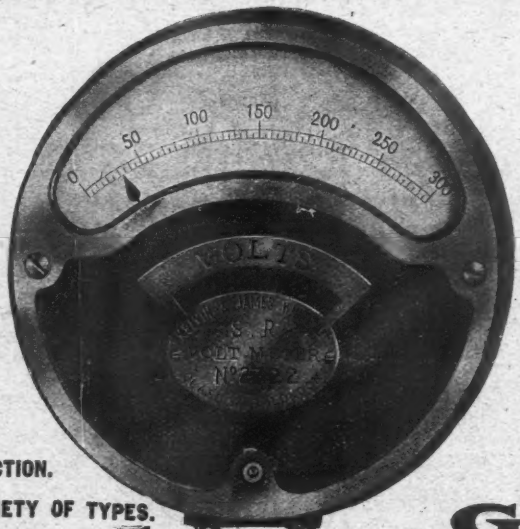

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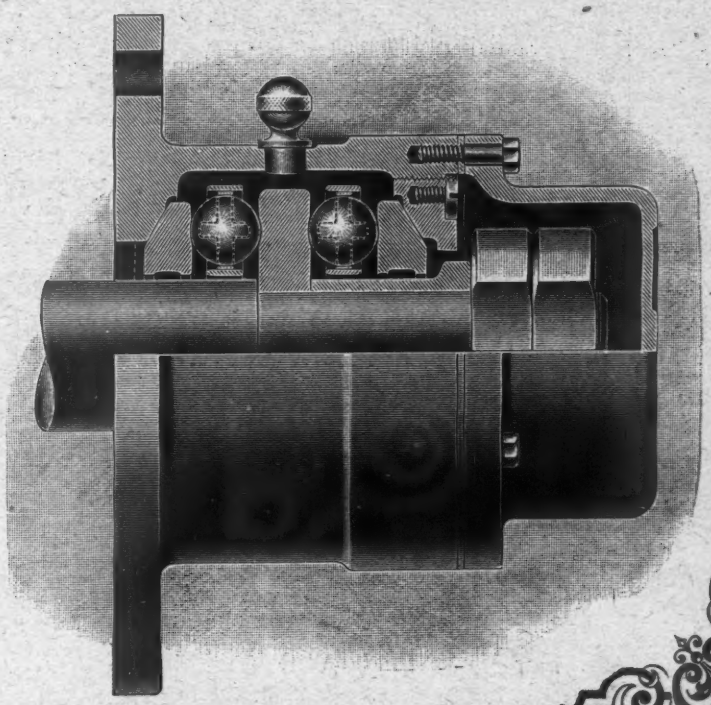

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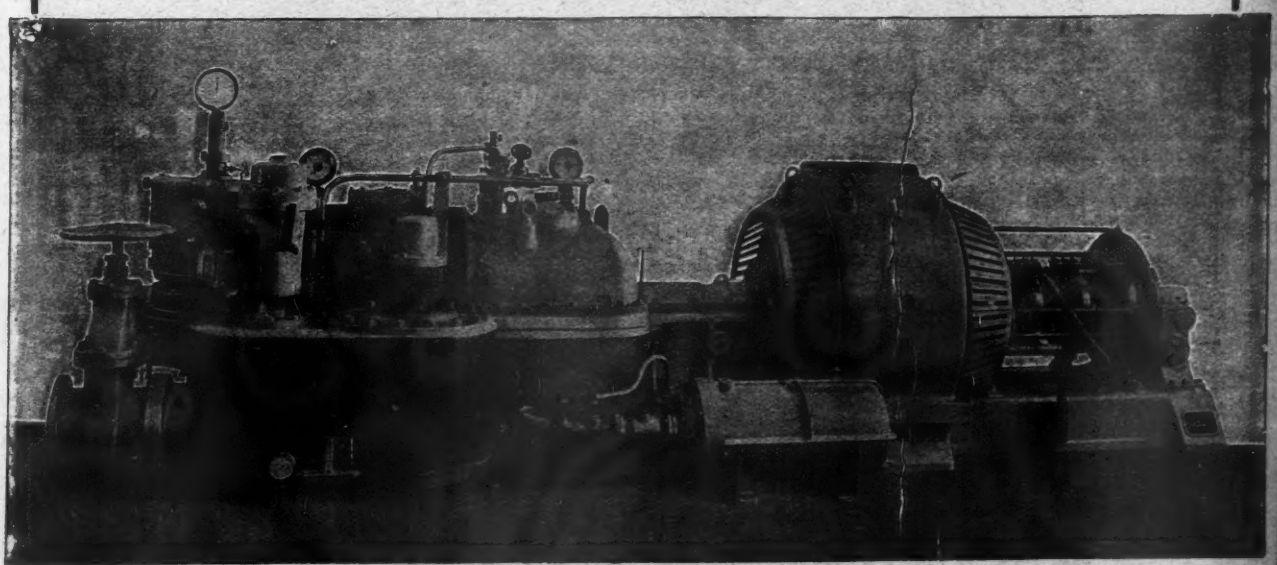

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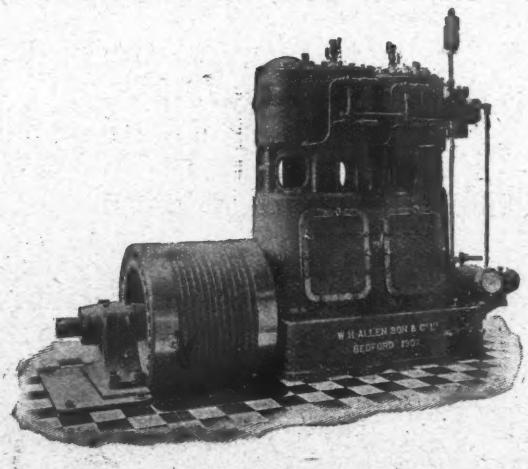

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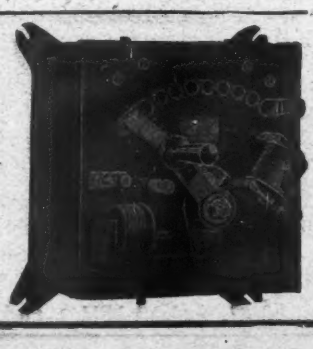

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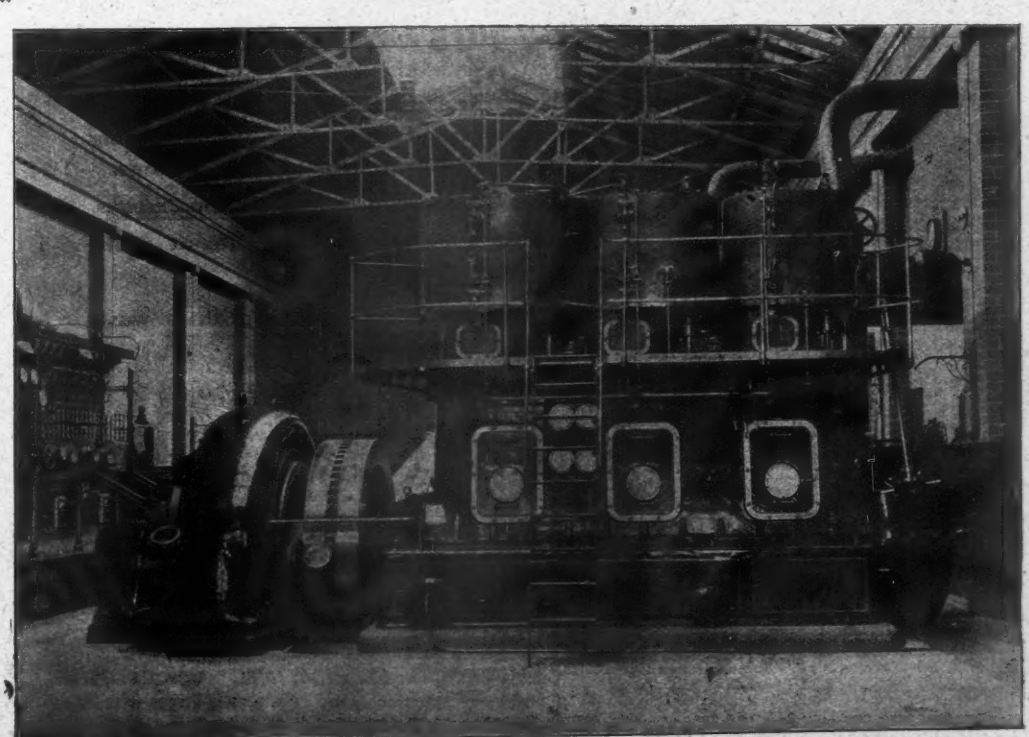

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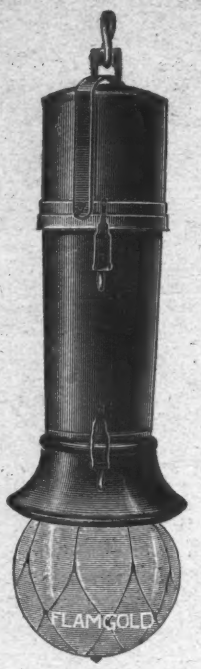

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V. E. DE BROË,
Secretary. 1507

(Continued on next page.)

SITUATIONS VACANT.—*Continued*

THE INSTITUTION OF ELECTRICAL ENGINEERS.

THE COUNCIL is prepared to consider applications for the Appointment of Secretary of the Institution from Candidates of good standing only, and of not more than 45 years of age. In making the selection importance will be attached to the following qualifications:—

Administrative Experience.
Tact and Business Capacity.
Acquaintance with the Profession.
Knowledge of Modern Languages.
Technical Knowledge.

Applications, stating salary required, and addressed to the "President of the Institution of Electrical Engineers, 92, Victoria Street, London, S.W.," must be delivered on or before TUESDAY, JANUARY 12th, 1909. 1451

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APPLYING for Appointments.—Perhaps something is wrong in your method. Many succeed my way. Let me state your case.—GREATOREX, 27, York Road, Ilford. 1383

GENERAL Manager required by Bruce Peebles & Co., Ltd., Edinburgh; must be thoroughly capable of taking entire charge of both manufacturing and commercial departments, a good organiser, and a man of sound experience in all details of the electrical engineering business. An adequate salary will be paid to a suitable man. Address stating salary expected, CHAIRMAN, Bruce Peebles & Co., Ltd., East Pilton, Edinburgh. 1513

JUNIOR Clerk, Metropolitan Borough Electricity Department. Shorthand, typewriting indispensible. Used to cost accounts preferred.—State age, experience, salary, 1506, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

JUNIOR Draughtsman wanted for electrical works; used to A.C. and D.C. machines. Must be neat and accurate.—State age, salary, and experience.—1512, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SHIFT Engineer required, £2 per week, Erith Urban District Council. Applications considered only from competent electrical and mechanical engineers having full experience with three-phase high-tension generating system, rotary converters, and traction supply.—Applicants to state previous experience and send three copies of recent testimonials to the ELECTRICAL ENGINEER AND TRAMWAYS MANAGER, Erith, not later than January 4th. 1501

SMART Man required with a sound knowledge of electrical and telephone work for inspection. Good wages to the right man. State age, experience, &c.—Apply 1508, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

VACANCY occurs for Premium Pupil in combined A.C. and D.C. central station.—Apply RESIDENT ENGINEER, Electricity Works, Scarborough. 1418

WANTED, thoroughly experienced Draughtsman, preferably one with some experience in the mechanical design of direct current turbo-generators.—State age, salary and experience to ELECTRICAL DEPT., Vickers Sons & Maxim, Ltd., Sheffield. 1295

WANTED, Foreman for machine shop manufacturing electric generator and motors of medium and large size; only first-class men used to piece-work need apply.—State age, salary and experience to ELECTRICAL DEPT., Vickers Sons & Maxim, Ltd., Sheffield. 1296

SITUATIONS VACANT.—*Continued.*

WANTED, Contract Clerk accustomed to installation work, state age, salary required, and experience.— 1509, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

If letters are not to be delivered to certain firms or individuals (if known), instructions to that effect should be sent to the Manager of the ELECTRICAL REVIEW, who will do his best to carry out such instructions. Letters of applicants cannot in such cases be returned to them, nor can the names of Advertisers using a number in any way be disclosed.

APPOINTMENTS FILLED.

SUB-STATION Assistant, Box 1434. Applicants kindly note that the above position has now been filled. 1498

THE Manager, Electricity Works, Woking, thanks the applicants for post of canvasser, &c. The vacancy is now filled. 1502

SITUATIONS WANTED.

Latest time for receiving 9.30 a.m., Thursday.

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A—AN Electrical and Mechanical Engineer (28), works and technical training, outside erection, central station (erection and running) and mining experience, also used to estimating for large power schemes, good business correspondent, desires post as Assistant to Manager or Consultant. Highest references and substantial financial guarantee if desired.—Apply 1382, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER (25), university education, drawing office and workshop experience, desires appointment home or abroad. —"L.," 24 South Hill Road, Liverpool. 1363

ADVERTISER, at present electrician-in-charge for large London caterers, with numerous branches, desires change; fully experienced all branches.—LEWIS, 150, Parkhurst Road, Manor Park. 1423

A MECHANICAL and Electrical Engineer (31) used to large contracts, overhead transmission, cables, traction or maintenance work, requires change. Home or abroad, excellent testimonials.—1407, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ARC Lamps, Switchgear and Electro-Magnetic Apparatus Expert Desiging Engineer (35) with workshop, D.O. and test-room training desires responsible position in works, used to shop management and control of unskilled labour. Highest references.—1408, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ARMATURE Winder seeks employment, alternating and continuous.—Apply 1488, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CABLE Jointer and Wireman, used to all cables.—W.Y., 66, Dennis Road, Eastbourne. 1404

CERTIFICATED Electrician, thoroughly experienced in installation work or charge of plant, seeks permanency.—1415, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CONFIDENTIAL Clerk (32), married, good address, education, 6½ years West End Contractors; showroom and storekeeping experience; excellent references.—1514, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(*Continued on next page.*)

SITUATIONS WANTED.—*Continued.*

ELECTRICAL and Mechanical Engineer (gentleman, 33), good connection with collieries, Durham, Northumberland (personally acquainted and connected with heads of above) open to offer as Outside Manager; consider taking good Agency.—1385, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer (30) shortly disengaged; 14 years' experience, electrical and mechanical, D.C., traction, E.H.T., polyphase, H.T. transmission, turbines.—1377, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER (25), B.Sc., three years large turbine factory; present assistant D.C. and A.C. central station; good testimonials; wants change.—1499, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

GENTLEMAN (25), experienced as Salesman, seeks permanent progressive appointment, would travel; pushing, energetic, references.—Z., The Schools, Kilburn Lane, Kensal Green. 1492

JOINTER, all classes of cables, own plumbing, house service work, excellent references.—"JOINTER," 12, Thirlmere Road, Muswell Hill. 1505

WIREMAN, disengaged, good all-round, wants Work.—J. B., 133, Praed Street, W. 1477

WIREMAN and Mate seek work. Light, bells, 'phones, power, plant. Good references. Disengaged.—"ELECTRIC," 3, Great New Street, E.C. 1483

£10 OFFERED for assisting Electrician to find suitable berth. Experienced lighting and power plants, &c., shop and technical experience. — 1489, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

PARTNERSHIPS.

ENGINEERING BUSINESSES, in sound condition, showing fair profits, and wanting Active Partners with capital; also Engineers of experience and means desiring Partnerships, are requested to communicate with

WHEATLEY KIRK, PRICE & CO.,
46, WATLING STREET, LONDON, E.C.,
Albert Square, Manchester, and
26, Collingwood Street, Newcastle-on-Tyne.

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ELECTRICAL Engineer, with considerable technical and practical experience, wants active employment with manufacturing or consulting firm; prepared to buy Partnership; must bear fullest investigations.—1515, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AGENCIES.

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A FIRST-CLASS Firm require agents in Newcastle, Bristol, and London, for the sale of Arc Lamps, Carbons, Cables, and all electric lighting supplies. Applicants must have a good connection and be able to carry a stock. Only established firms need apply.—1510, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AGENCIES.—*Continued.*

ADVERTISER, Electrical and Mechanical Engineer of high qualifications, shortly terminating long engagement with large Power Co., North-East Coast, joining another having highest connection with engineering firms, shipyards, collieries, supply companies, municipal authorities, &c., is open to Represent good reputable Firm of Manufacturers.—Address, 1430, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AGENTS wanted for Great Britain, by efficient Continental arc lamp manufacturer. Only those well introduced to the trade, and who can furnish references, will address M. Z., 527, Haasenstein & Vogler, Berlin No. S. 1439

ESTABLISHED Agents wanted for the sale of Automatic Crane and Lift Control Gear. Home and Abroad.—1497, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

BUSINESSES FOR SALE AND WANTED.

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WANTED to purchase, small Contracting Business; light, bells, &c.; must be in City or W.C.—Apply 1450, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR SALE.

POWER STATION PLANT FOR SALE.

THE HULL CORPORATION are prepared to receive offers for the following Plant, which has been removed to make room for other plant, viz.:—

One Babcock & Wilcox boiler, evaporative power about 3000 lbs. per hour, with mountings complete, except vertical tubes, which have been cut.
One compound-wound 300-KW. Tramway Generator, 550 amps., 550 volts, 360 r.p.m., with coupling for direct drive.
One 8" centrifugal pump, capacity 1000 gallons per minute at 450 revs.
One three-throw geared Feed Pump, capacity 1500 gallons per hour.

Further particulars may be obtained of the CITY ENGINEER, Hull, or of the TRAMWAYS ELECTRICAL ENGINEER, Alfred Gelder Street, Hull.
No special form of tender is required. 1475

ELECTRICALLY-DRIVEN AIR-COMPRESSING PLANT.

2 INGERSOLL-RAND Belt-Driven Air-Compressors. Capacity 2637 c. ft. free air per minute each machine.
2 ditto, ditto. Capacity 1414 c. ft. free air per minute each machine.
1 Ingersoll-Sergeant Belt-Driven Air-Compressor with automatic unloader. Capacity 285 c. ft. free air per minute.
1 Holman Compressor, Belt-Driven. Capacity 300 c. ft. free air per minute.

Electric Motors for driving above complete with starters, switches and fuses.

1 215-H.P. 480-volts D.C. Motor.
1 205-H.P. 400-volts Single-Phase Motor.
2 110-H.P. 400-volts D.C. Motors.
2 14-H.P. Electric Motor Hoists.

All above Machines are in excellent order.

Further details and prices from:—

THE TILBURY CONTRACTING & DREDGING CO., LTD.,
L. C. C. Sewer Works,
Tower Bridge Road, S.E.
1435

(*Continued on next page.*)

FOR SALE.—*Continued.*

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CASTLE Dynamo, compound-wound, 80 amps., 110 volts, splendid condition, £21.—SMITH, Carlton Place, Halifax. 1381

DYNAMOS, 3000, 1500, 1000 and 750 amperes, at 6 volts, ready for delivery; also smaller sizes delivered from stock. Machines let out on hire.—CANNING & Co., Electro-Platers' Engineers, Birmingham. 8025

EIGHTY Dynamos and Motors for Sale or Hire.—MARTIN, Electrical Engineer, Kidderminster; Birmingham Depôt, 320, Witton Road. 1003

FOR Sale.—Electric Plant, consisting of 12-H.P. Tange's Gas Engine, one Parker's shunt-wound belt-driven Dynamo and Chloride Battery.—1481, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale.—150 KW. Generating Set, 230 volts 625 amps. 390 revs.; Vertical Compound Corliss Condensing Engine, 16" × 32" × 36"; Horizontal Compound Corliss Condensing Engine, 17" × 28" × 42"; 51-B.H.P. Stockport Gas Engine; 27-B.H.P. Crossley Gas Engine; 24-B.H.P. Oil Engine (by Blackstone); Dynamo, 220 volts 310 amps. 500 revs.; Dynamo, 220 volts 250 amps. 850 revs.—Full List of over 3000 lots of Machinery post free, THOS. W. WARD, LTD., Albion Works, Sheffield. Telegraphic Address: "Forward, Sheffield." 7809

FOR Sale or Hire, high-class Dynamos, Motors, Alternators, Cable and Arc Lamps.—PERCY HUDDLESTON & Co., 72, Finsbury Pavement, E.C. 1218

FOR Sale.—"ELECTRICAL REVIEW," Volumes 1 to 52, first nine bound in publishers covers, remainder half leather. All clean and in good condition. What offers?—1192, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

GAS Engines, 40 B.H.P., Crossley; 18 B.H.P., ditto; 12 B.H.P., ditto; 12 B.H.P., Tangye; 8 B.H.P., Crossley; all in excellent condition and cheap to clear.—H. H. GARDAM, Staines, Middlesex. 1301

GENERATOR, 115 volts, 1050 amps., 435 revs., by Holmes & Co., direct-coupled to two-crank enclosed engine, 180 B.H.P., 125 lbs. steam pressure, by Browett, Lindley & Co. Condition good, nearly new.—F. W. TAYLOR, Electrical Engineer, Milnsbridge, Huddersfield. 1390

MOTOR.—Continuous, 480 volts, 5 amp., 3¼-H.P. with starter. Nearly new condition, cost £38, will accept £14.—Apply SUCKLING, JUNR., Hendon, N.W. 1373

THE Baby Blow-Lamp burns pint petrol in eight hours; will solder 19/18 joint. Just what you want. 8s. 6d. post free.—WELSH, Tytherly, Clarence Road, Parkstone. 1471

THE Practical Electrician's Pocket Book and Diary for 1909 is now ready. Carefully revised and enlarged and thoroughly up-to-date. Best value for money. Cloth 1s. 2d., leather 1s. 8d. (with insurance), post free, from RENTELL, 36, Maiden Lane, Strand, London. 1392

ARTICLES WANTED.

WANTED TO PURCHASE FROM ELECTRIC LIGHTING Companies and Electrical Engineers, Dynamos, Motors, Cable, Wire, Instruments, and every description of Electrical Material, also Manufacturers' Surplus Stocks. The bulk being for re-use, high cash prices can be paid.—A. VEREY & Co., Dover. Principal in London three days a week. Telegraphic Address: "Verey, Dover." 8514

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ACCUMULATORS, Second-hand, any type, wanted; also Dynamos and Machinery, Lead Peroxide, Old Copper Cable, Scrap Metals, and every description of Metallic Dross purchased for cash, town or country.—Write A. BROWN & SONS, 142, Lower Clapton Road, N.E. Telephone: 1355 North. 9474

ACCUMULATORS.—Scrap Battery Plates bought; best prices given.—H. V. BEEBEE, Lambton Road, Worsley, Lancs. 324

DYNAMO, old, any make or size, for experimental purposes. Price and particulars to Ross Works, Birksland Street, Bradford. 972

GOOD second-hand motor required, 8/9 H.P., 90 volts, for direct current. State speed and price to the D.P. BATTERY Co., LTD., Bakewell. 1503

OLD Electric Lamp Ends, Cable and Wire bought for cash.—SMITH & Co., 2, Ranelagh Road, East Ham, London, E. 2818

PLATINUM, in any form and quantity, purchased at highest prices by DERBY & Co., LTD., 44, Clerkenwell Road, London. 6522

PLATINUM Scrap wanted.—EDEY & Co., 29, Ludgate Hill, London. 1009

WANTED, New or Secondhand Cable-covering Machinery.—Reply, stating full particulars to 1357, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Metals, India-Rubber, &c., of every description for prompt cash.—Send for prices paid by BUCKLEY'S LIMITED, 42, Hargrave Park, Junction Road, Highgate. 1504

WANTED, a 40 to 50 KW. Steam Set, 200 volts, 25-B.H.P. Gas Engine, suitable for suction gas. 60-B.H.P. Gas Engine suitable for suction gas. 40-KW. Dynamo at 200 volts, 50 ditto. R. W. & S., Rutland Street, Leicester. 1500

MISCELLANEOUS.

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COVERINGS for Heat.—Insulating accurately tested by electrical method.—Send for particulars to A. P. STROHMENGER, Harrow-on-the-Hill. 1178

(Continued on next page.)

MISCELLANEOUS.—*Continued.*

EPSTEIN Accumulator Plates for Storage Batteries are now supplied by the sole licensees and makers, W. O. ROOPER AND Co., Electrical Engineers, Stafford. 80

LEAD Burning.—Lowest prices. Accumulators or tanks.—"H.," 3, College Street, Putney. 554

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SUCCESSFUL INVENTORS

HAVE THEIR IDEAS WORKED OUT AND MODELS MADE AT

W. K-L. DICKSON'S

ELECTRICAL AND MECHANICAL LABORATORIES,
4, Denman Street, Piccadilly Circus, London, W.
Telephone, GERRARD 4563. Telegrams: "LAURIONITE," LONDON.

THE STIRLING BOILER CO., Ltd.,
Head Office: 25, VICTORIA STREET, WESTMINSTER, S.W.
See Illustrated Advertisement last week.

John E. Raworth,
Queen Anne's Chambers, 30, The Broadway, Westminster, S.W. Chartered Patent Agent.

NOTES ON THE PATENTS AND DESIGNS ACT, 1907
By Messrs. LLOYD WISE & CO., Chartered Patent Agents.
Can be obtained from their Offices, 40, Lincoln's Inn Fields, London W.C. (Price 1s.).

THE 'PATENTEE'S HANDBOOK.'
By J. G. LORRAIN, M.I.E.E., M.I.Mech.E., CHARTERED PATENT AGENT.
Gives full information and advice to intending Patentees. Sent post-free on application to Mr. J. G. LORRAIN, Norfolk House, Norfolk Street, Strand, London, W.C.

TRANSFERS.—IMPORTANT NOTICE.
We saved one Electrical Firm 14/6 per dial on 250 dials by introducing Transfers the other day, which TRANSFERS also gave them a more satisfactory article. WHY don't you consider this question, perhaps we might be able to show you a similar saving if you gave us the opportunity of learning your requirements.
52 to 60, Steelhouse Lane, Birmingham.

ENGELBERT & CO., London,
LUBRICANT MANUFACTURERS.
Vide full advertisement in last issue, also next issue.

2-VOLT NON-SPILLING ACCUMULATORS
For POCKET LAMPS
SENT FULLY CHARGED.
Each 2/6. .. .. DOZ. 27/.
Not charged, 3d. each less.
ACCUMULATORS FOR HAND LAMPS.
Charged.. .. .. 3/6 each.
Not charged .. .. 3/- ,,
Liberal Trade Discounts.

ARCHIBALD J. WRIGHT, Ld., Manufacturing Electricians, Leyton Green Rd., London, N.E.

Illustrated. XI. Tables.
SECONDARY BATTERIES
A PRACTICAL HANDBOOK FOR OWNERS & ATTENDANTS.
4s.
Post Free.
BY AN ENGINEER.
H. ALABASTER, GATEHOUSE & CO.,
4, LUDGATE HILL, LONDON, E.C.

UNIVERSAL ELECTRICAL DIRECTORY.

THE 1909 Edition, to appear during January, has been as carefully compiled as previous Editions, and no pains have been spared to make it an accurate and reliable work of reference.

The Geographical Section renders it indispensable for travellers, while Manufacturers and Contractors will find most useful particulars in the lists of Electricity Works in the United Kingdom, British Colonies and some other countries. The financial particulars of Limited Liability Companies are again given, and Telegraphic Addresses and Telephone Numbers are also included. All the information is arranged alphabetically, and a Thumb Index facilitates the turning up of any section.

Write for Prices to

H. ALABASTER, GATEHOUSE & CO.,
4, LUDGATE HILL, LONDON, E.C.

"THE STREELITE."

Patent No. 2103.

Registered Nos. 519,387 & 519,388.

The Wardle Engineering Company having bought the Sole Patent Rights and Registered Designs for the above Lamp, are now prepared to supply any number from stock.

For further particulars apply to—

THE WARDLE ENGINEERING CO.,

112, PORTLAND STREET, MANCHESTER.

Telephone No. 8097. Telegraphic Address: "Chamen, Manchester."

HAND POLISHED BLOCKS!

Have you noticed the difference in

BLOCKS and PATRASSES

after being in use 12 months? Some are bright and show the grain of the wood, others are quite dull. The first are hand polished, the others are not. Ours are all hand polished.

BROWN & CO.,

WATERLOO SAW MILLS,

73 to 85, McAlpine St., Glasgow.

Telegrams: "Boxes, Glasgow."
Telephones: 566, 567 Argyle; 567 P.O.

APPLIED MAGNETISM:

An introduction to the design of Electro-magnetic Apparatus.

75 Illustrations, Many Original.

7/6

Seven Tables.

By J. A. KINGDON, B.A., Formerly Math. Schol. Pem. Coll., Oxon.

CLOTH. POST FREE.

H. ALABASTER, GATEHOUSE & CO.,
4, LUDGATE HILL, LONDON, E.C.

LIST OF

PROFESSIONAL PAPERS

Published by the Council of the Institution of Post Office Electrical Engineers.

	Price.	Post Free
The Telegraph Acts. Mr. R. McIlroy	9d.	10d.
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Electric Wave Propagation (with diagrams). Mr. J. E. Taylor ...	9d.	10d.
Telephone Trunk System: Signalling Arrangements (with diagrams). Mr. J. S. Brown	9d.	10d.
The Construction of Telephone Lines (with diagrams). Mr. A. Moir ...	9d.	10d.
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Improvements in Telephonic Transmission over Underground Circuits by the Insertion of Inductance Coils (with diagrams). Mr. T. Plummer ...	1/-	1/2
Underground Construction (Provinces) (with diagrams). Mr. A. O. Gibbon	9d.	10d.
The Construction of Aerial Lines (illustrated). Mr. J. H. M. Wakefield	1/-	1/2

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

NEW BROTHERTON TUBE Co., LD.

Commercial Road, WOLVERHAMPTON.

ENAMELLED STEEL CONDUITS

SEND FOR NEW ILLUSTRATED CATALOGUE JUST ISSUED.

Reduced Prices. Novel Designs.

Also Gas and Steam Tubes.

THE BEST.

WITHSTAND SEVERE
VIBRATION.
BURN IN ANY POSITION

"TANTALUM" LAMPS

THE CHEAPEST

Economical Current Consumption.
MORE LIGHT AT REDUCED COST.

Information regarding Special "Tantalum" Lighting Combinations supplied on application.

SIEMENS BROTHERS DYNAMO WORKS, LIMITED,

Branches:

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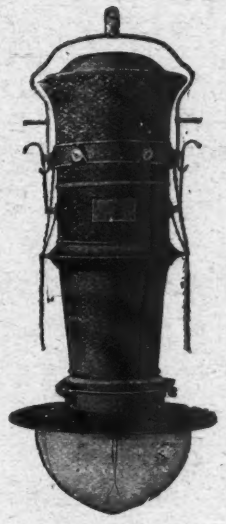
Newcastle.	Leeds.	Birmingham.	Bombay.	Madras.	Calcutta.
Cawnpore.	Rangoon.	Singapore.	Cape Town.	Penang.	Johannesburg.
		Sydney.	Melbourne.		

Arc Lamps



WESTINGHOUSE flame-arc lamps are made for a.-c. or d.-c. circuits, and will burn for 10 to 34 hours without re-carboning. Steady and powerful light with low current and carbon consumption. Few working parts and these fully protected from the heated gases rising from the arc.

WESTINGHOUSE enclosed-arc lamps are supplied for a -c. or d.-c. circuits and are suitable for indoor or outdoor lighting. Will burn from 60 to 80 hours with one trimming of carbons. Extremely simple in construction, highly efficient, and have low current and carbon consumption.

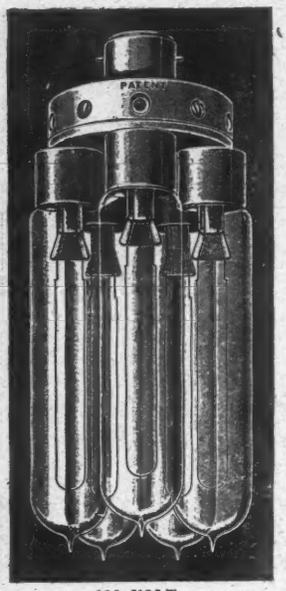
SUPPLY DEPARTMENT

Westinghouse

Manchester

Diploma of Honour, Franco-British Exhibition, 1908.

THE STEARN PATENT



100 VOLT.
B.—ONE HALF NATURAL SIZE.

ENGLISH MADE

SERIES LAMP

"Leuconium." (Regd.)

Made for 100 and 200 Volt Circuits.

Efficiency about 1·25 to 1·4 per English Candle.

SPECIAL & UNIQUE ADVANTAGE.

Renewal Tubes can be obtained at a very low figure, thus reducing the loss by premature failure or accidental breakage to a minimum.

Write for Full Particulars to:—

THE STEARN ELECTRIC LAMP CO., Ltd.,

47, VICTORIA STREET, WESTMINSTER, S.W.

PATENTED.

8 to 10 AMPS.
10 Hours.
£4 - 10 - 0 (Subj.).

SINGLE ENCLOSED AND FLAME ARC LAMPS.

SIMPLE!
MECHANICAL!!
CHEAP!!!

EVERY PART GUARANTEED
BRITISH MANUFACTURE.

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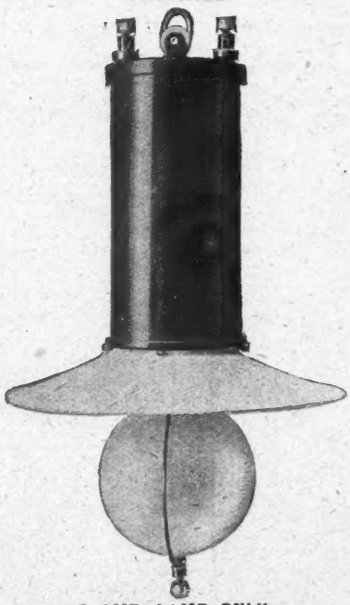

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NOTICES RELATING TO PATENTS.

Latest time for receiving, 9.30 a.m. Thursday.

THE PROPRIETOR of the Patent No. 29,406 of 1906, for "Improvements in Electric Contact Devices," is desirous of entering into arrangements by way of licence and otherwise on reasonable terms for the purpose of exploiting the same and ensuring its full development and practical working in this country. All communications should be addressed in the first instance to—

HASELTINE, LAKE & CO.,
Chartered Patent Agents and Consulting Engineers,
7 and 8, Southampton Buildings, Chancery Lane, London, W.C. 1452

THE PROPRIETOR of the Patent No. 26,590 of 1905, for "Apparatus for Generating and Utilising High Tension Alternating Currents for the Ignition of Explosive Mixtures in Internal Combustion Engines," is desirous of entering into arrangements by way of licence and otherwise on reasonable terms for the purpose of exploiting the same and ensuring its full development and practical working in this country. All communications should be addressed in the first instance to—

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7 and 8, Southampton Buildings, Chancery Lane, London, W.C. 1453

THE PROPRIETOR of the Patent No. 176 of 1906, for "Improvements relating to the Regulation or Control of Electric Motors," is desirous of entering into arrangements by way of licence and otherwise on reasonable terms for the purpose of exploiting the same and ensuring its full development and practical working in this country. All communications should be addressed in the first instance to—

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OFFICIAL NOTICES.

Latest time for receiving, 9.30 a.m. Thursday.

COMMONWEALTH OF AUSTRALIA.

Postmaster-General's Department,
Melbourne, 6th November, 1908.

TENDERS are invited for the supply of a Branching Metallic Multiple Magneto Switchboard to the Postmaster-General's Department in New South Wales.

Tender Forms and Specifications may be obtained at the Commonwealth Office, London.

SAMUEL MAUGER,
Postmaster-General. 1455

BECKENHAM URBAN DISTRICT COUNCIL.

THE URBAN DISTRICT COUNCIL are prepared to receive Tenders for the Supply of Electricity Meters.

Specifications, General Conditions and Forms of Tender may be obtained on payment to the Council's Collector at the Council Offices, Bromley Road, the sum of Two Guineas. This sum is required as a deposit, and will, after the Council have entered into a Contract upon the Tenders received, but not before, be returned to the Tenderer, provided that he shall have sent in a *bona fide* tender and shall not have withdrawn the same. In any other case this deposit will be forfeited.

For any further information with regard to the proposed contract application should be made to the Resident Engineer, Mr. J. E. Tapper, Electricity Works, Church Fields Road, Beckenham.

The Tenders must be sent in on the official form, and all instructions contained therein must be complied with.

Tenders, endorsed "Meters," must be addressed to the undersigned, and delivered at the Urban District Council Offices, Beckenham, not later than 4 p.m., on MONDAY, JANUARY 4th, 1909.

The Council do not bind themselves to accept the lowest or any Tender.

By Order,
F. STEVENS,
Clerk of the Council.

14th December, 1908. 1457

OFFICIAL NOTICES.—*Continued.*

FAREHAM URBAN DISTRICT COUNCIL.

ELECTRICITY WORKS.

THE COUNCIL are prepared to receive Tenders for the following:—

SECTION B.—Three Alternators and Exciters.
" C.—High and Low Pressure Switchboards.
" D.—Overhead Travelling Crane.

The General Conditions and Specifications may be obtained at the offices of Messrs. MAY & HAWES, the Consulting Engineers of the Council, Caxton House, Westminster, S.W., on making a deposit of £5, which will be refunded to *bond fide* Tenderers.

Tenders, sealed and marked "Tender for Electricity Works," must be addressed to the undersigned and delivered before 10 a.m. on WEDNESDAY, JANUARY 20th, 1909.

The Council do not bind themselves to accept the lowest or any Tender.

LEONARD WARNER,
Clerk of the Council.

Urban District Council,
Fareham,
December 17th, 1908. 1490

BURGH OF LEITH.

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THE CORPORATION of the Burgh of Leith invite Tenders for the Supply, Delivery, and Erection of:—

One 600 K.W. Steam Dynamo.

Tenders will be considered only for the whole of the work covered by the Specification, and not for any part thereof.

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Sealed Tenders, endorsed as directed in the General Conditions, to be delivered to me, at the Council Chambers, Leith, not later than WEDNESDAY, the 6th day of JANUARY next.

The Corporation do not bind themselves to accept the lowest or any tender.

T. B. LAING,
Town Clerk.

Council Chambers,
Leith,
16th December, 1908. 1456

BOROUGH OF MIDDLESBROUGH.

Street Lighting.

TENDERS are invited for the supply, delivery and erection of the following:—

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Specifications and Form of Tender may be obtained from Mr. H. M. TAYLOR, Borough Electrical Engineer, Snowdon Road, Middlesbrough, on payment of a deposit fee of One Guinea, which sum will be refunded on receipt of a *bond fide* Tender.

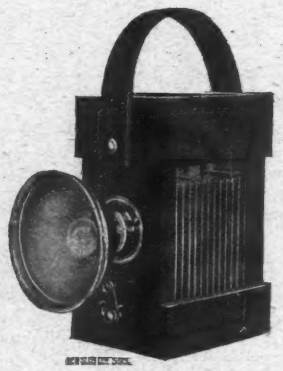
Sealed Tenders, endorsed "Street Electric Lighting," to be delivered at my office on or before 12 noon, WEDNESDAY the 30th inst.

ALFRED SOCKETT,
Town Clerk.

Municipal Buildings,
Middlesbrough. 1448

Continued on Page 39.

ELECTRIC
HAND LAMPS.



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OFFICIAL NOTICES.—*Continued from page 87.*

BOROUGH OF PORTSMOUTH.

THE CORPORATION invite Tenders for the following Materials to be used in connection with the Construction of the Goldsmith Avenue Tramways Route (about one mile):—

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Pitch and Creosotes Oil.
Thermit Joints.
Rails, B.S. Section, No. 3.
Tiebars.

CONTRACT No. 17.

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Any further particulars can be obtained, and Drawings seen, on application to Mr. V. G. LIRONI, M.I.M.E., A.M.I.E.E., Tramways Engineer, Engineer's Office, Vivash Road, Fratton, Portsmouth.

The Form of Tender must include a declaration that the person or firm making the tender pays not less than the Trade Union Rate of Wages and observes the hours of labour and conditions recognised and in practice obtained by the trade unionists in the place or places where the contract is executed.

Tenders must be delivered to the Town Clerk, Town Hall, Portsmouth, not later than 12 noon on MONDAY, JANUARY 4th, 1909.

The Corporation do not bind themselves to accept the lowest or any tender.

ALEXANDER HELLARD,
Town Clerk.

Town Hall, Portsmouth,
December 15th 1908. 1474

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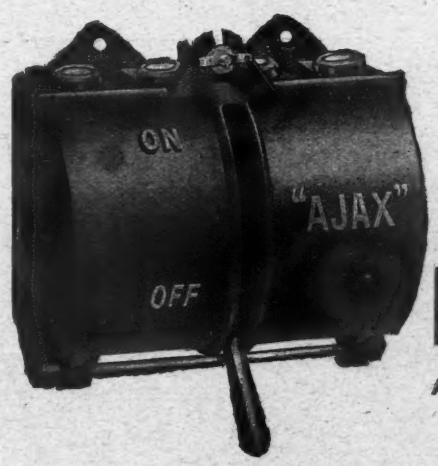

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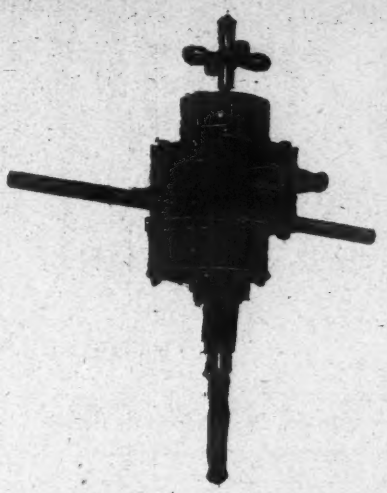

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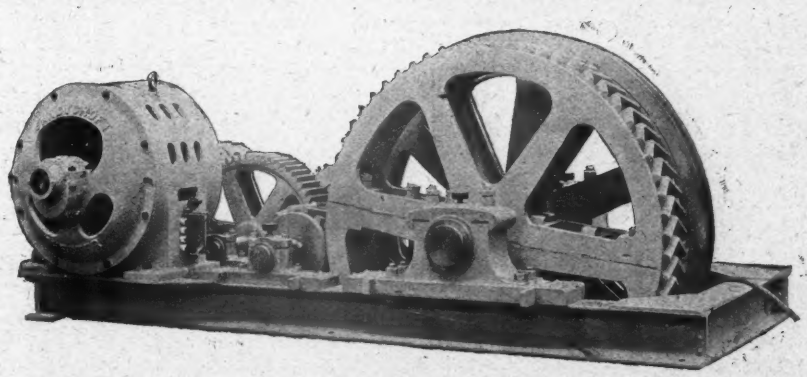

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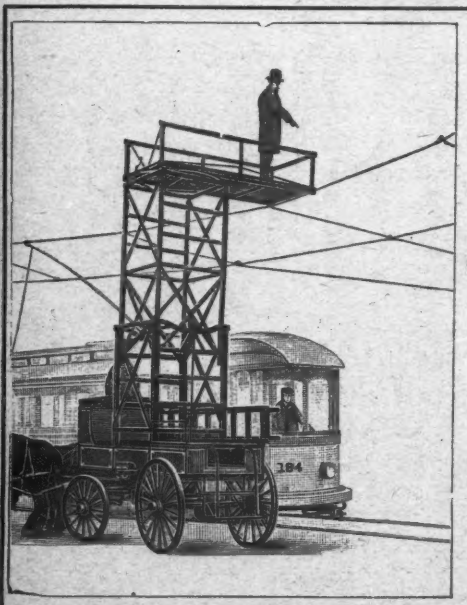

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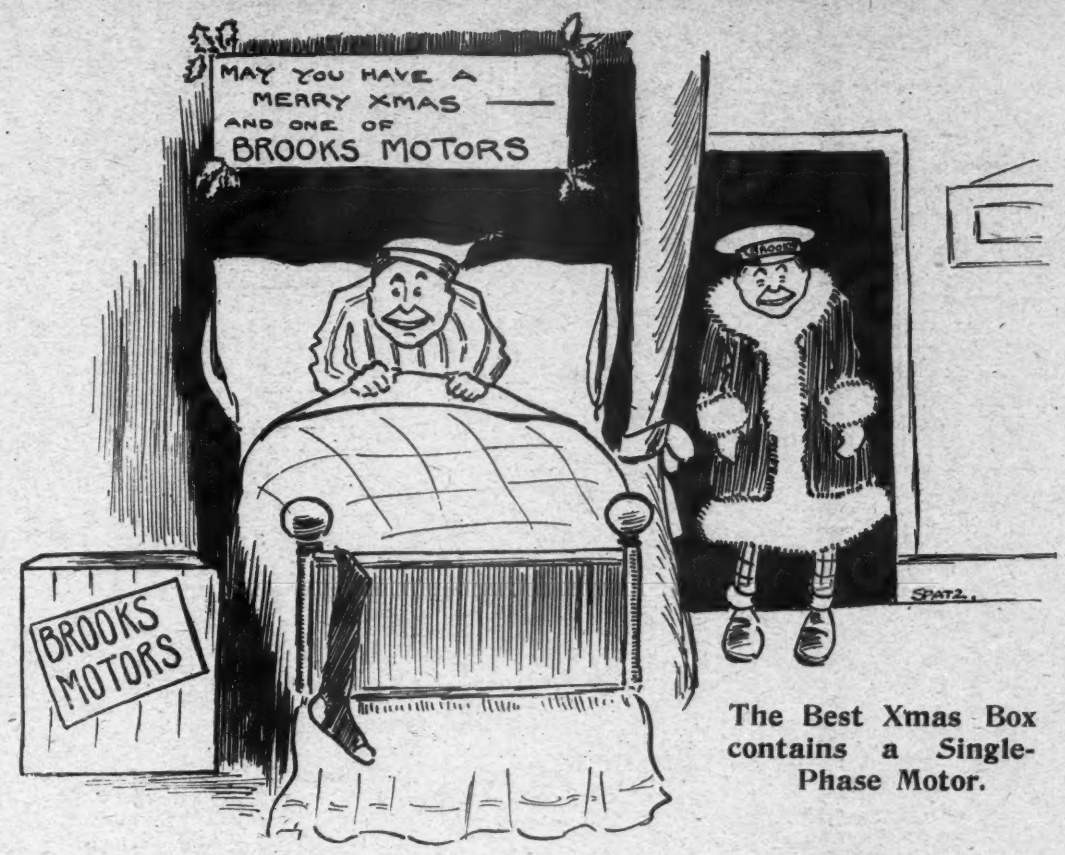

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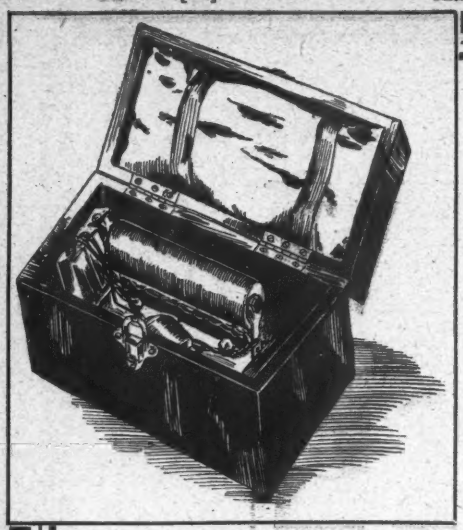

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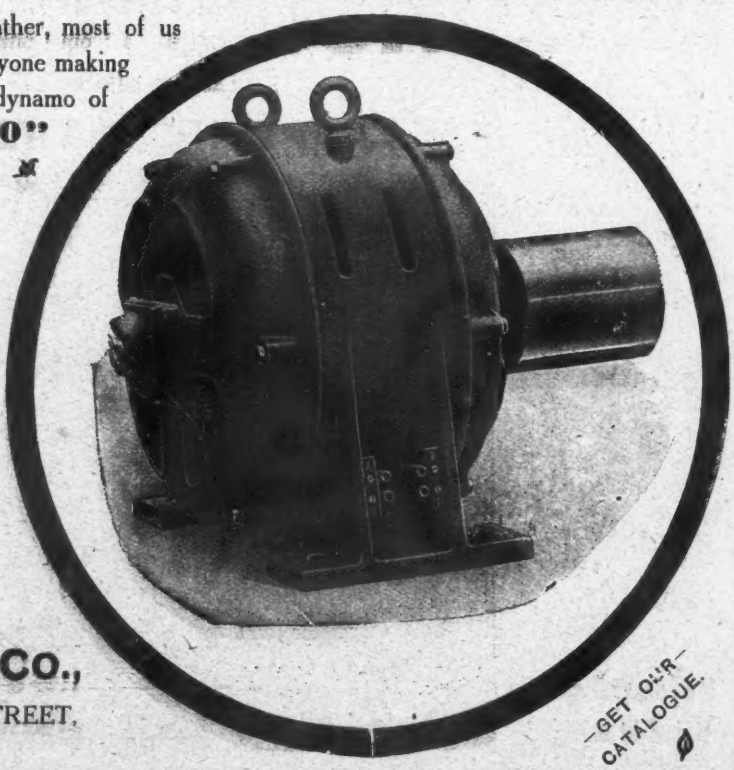

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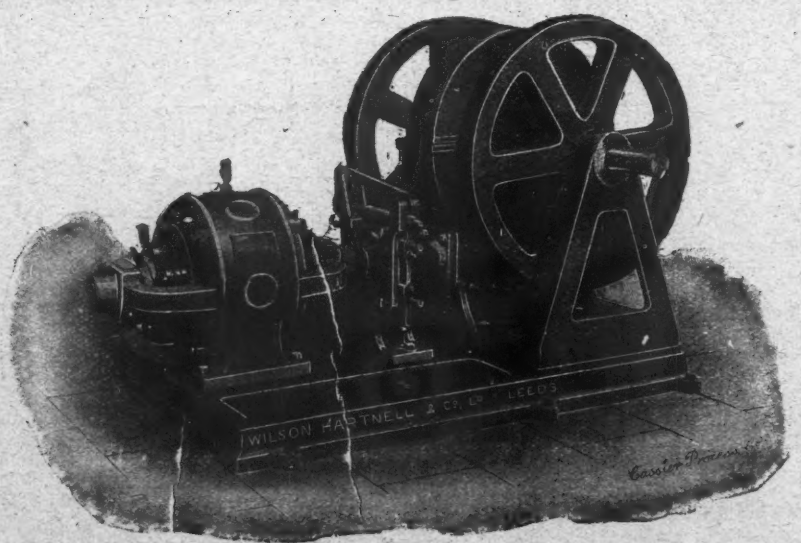

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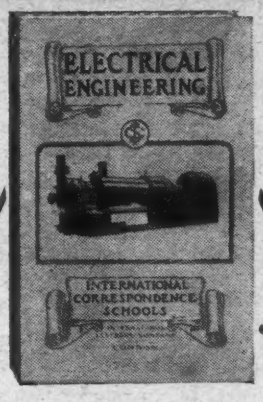

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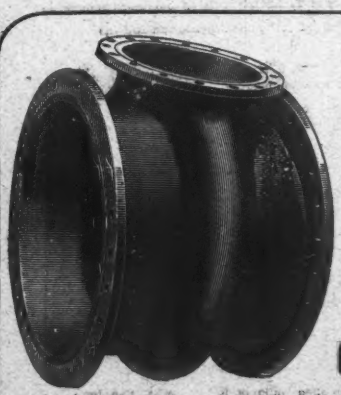

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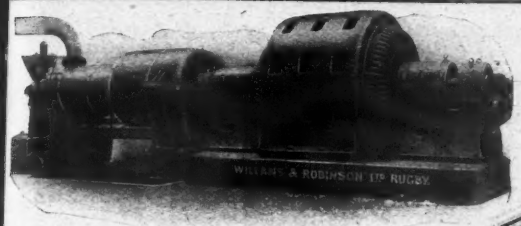

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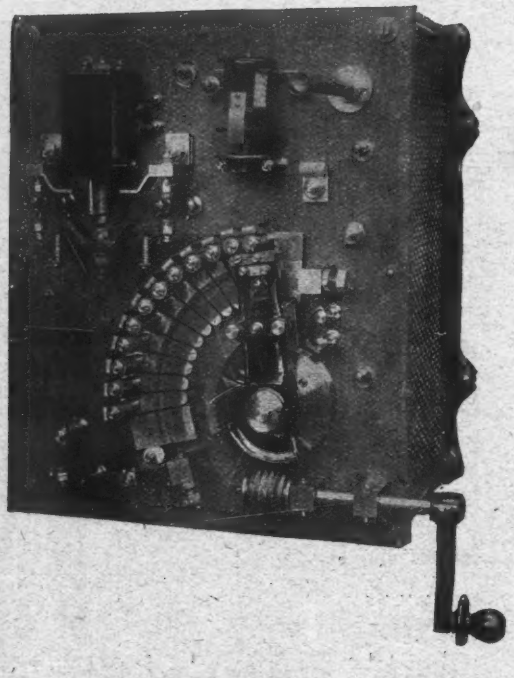

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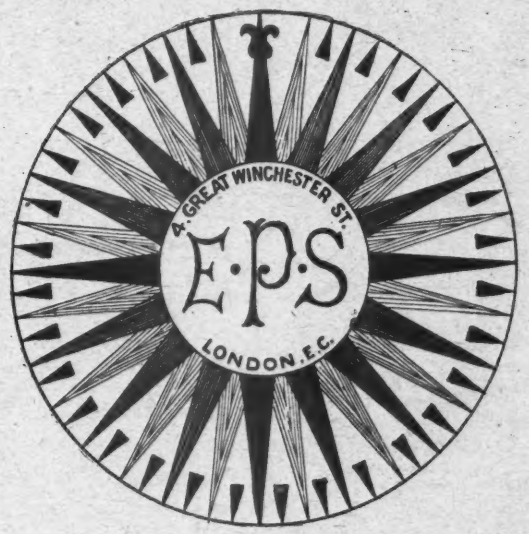

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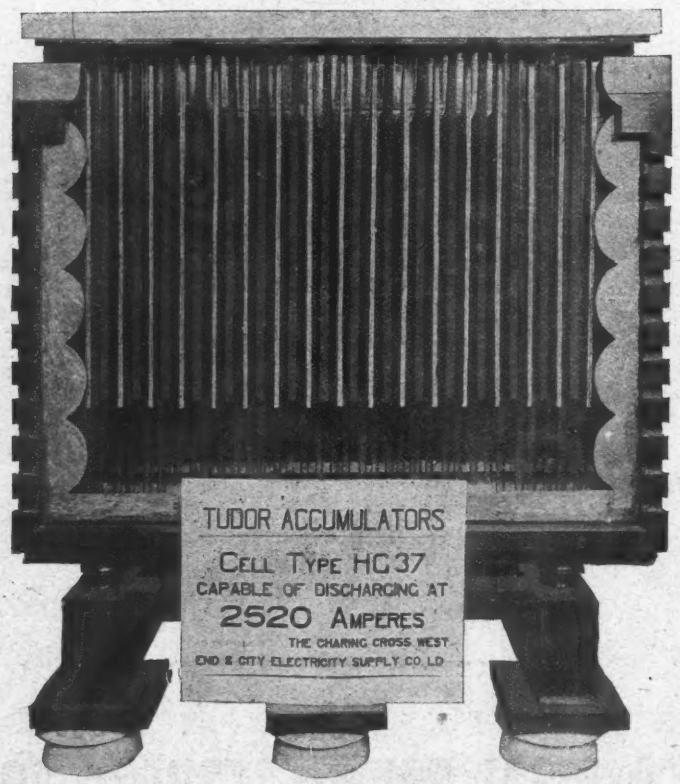

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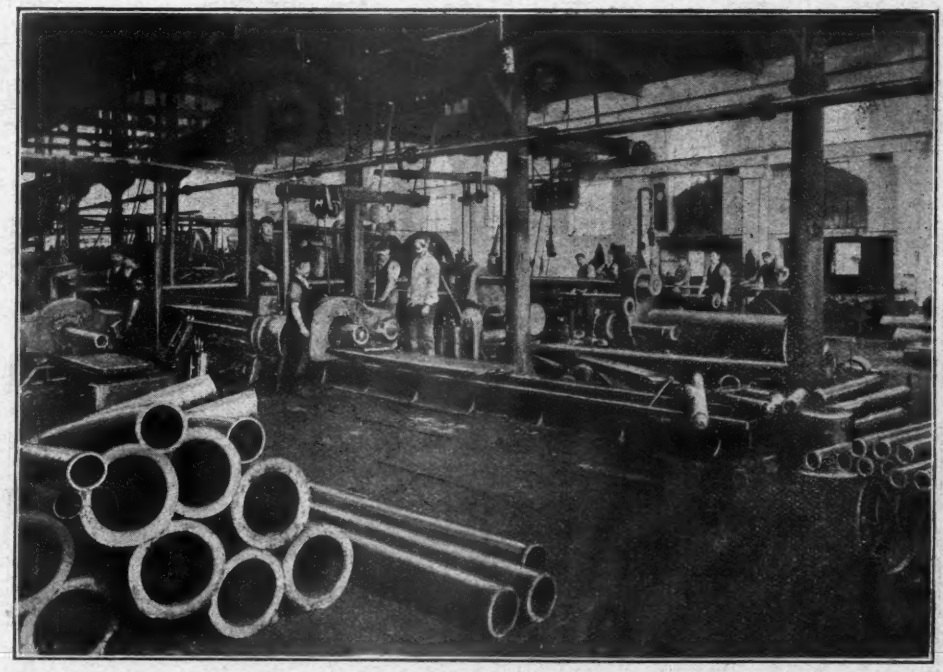

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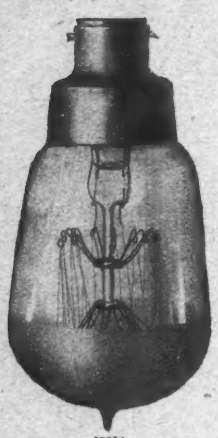

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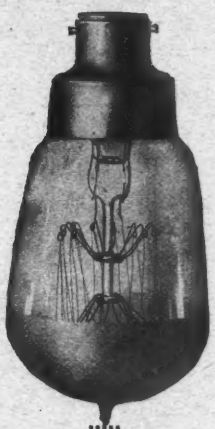

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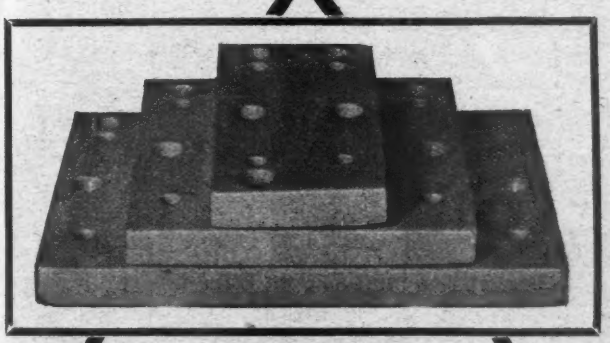

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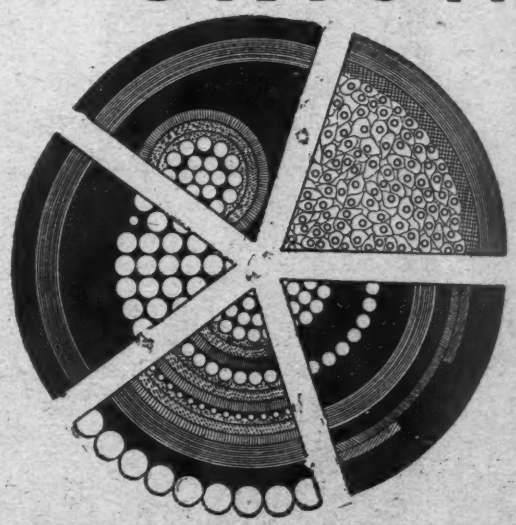

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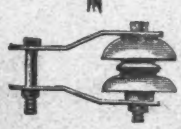

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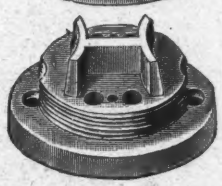

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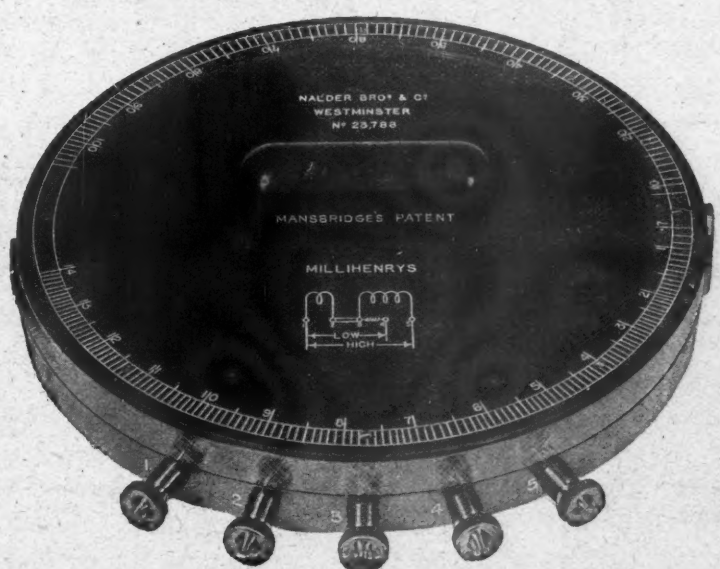

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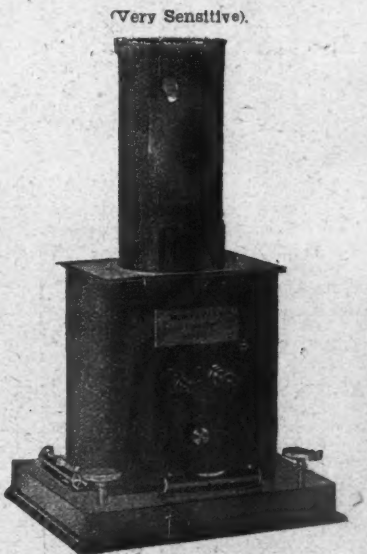

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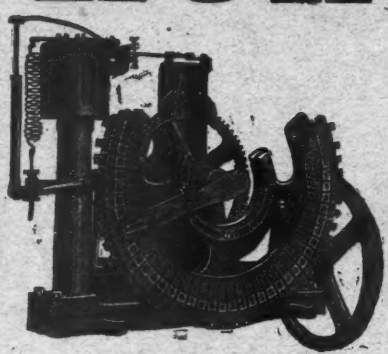

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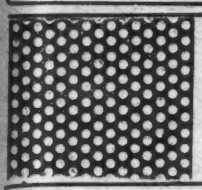

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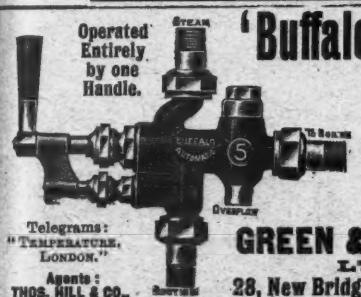

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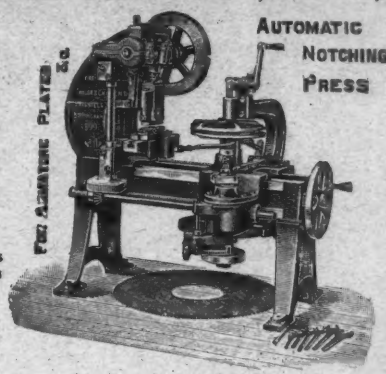

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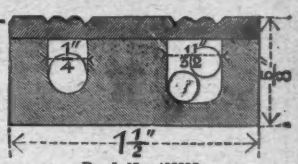

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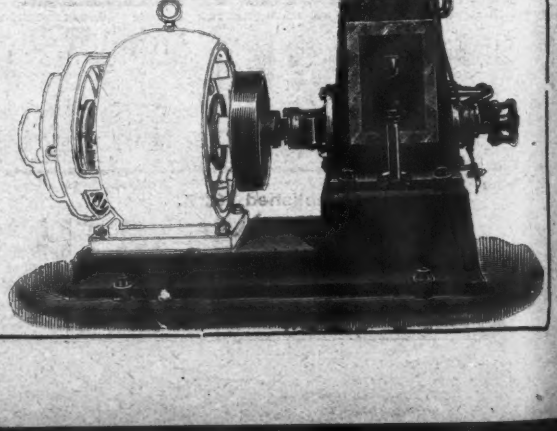

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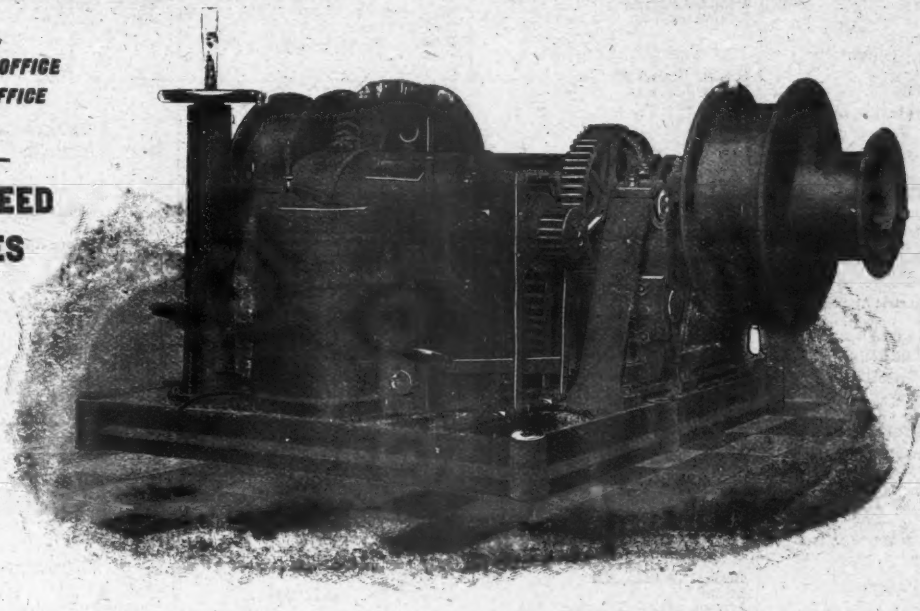

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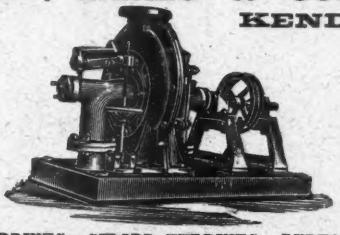

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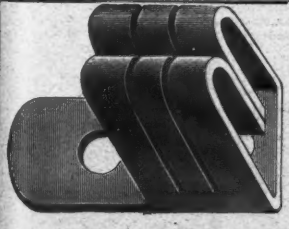

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Continued on page 64.

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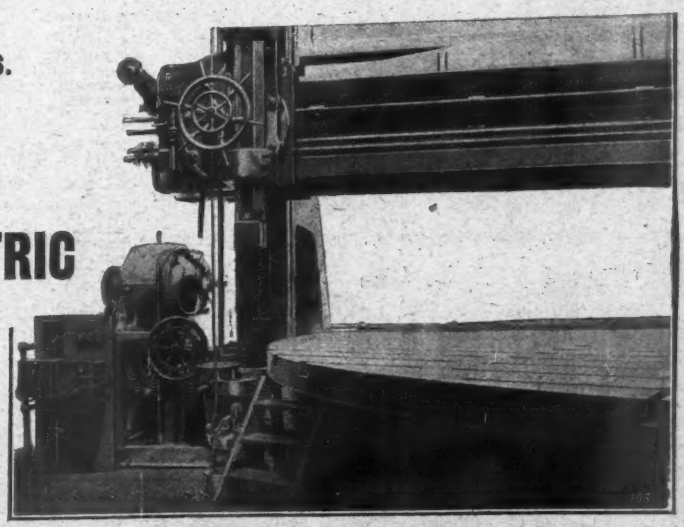

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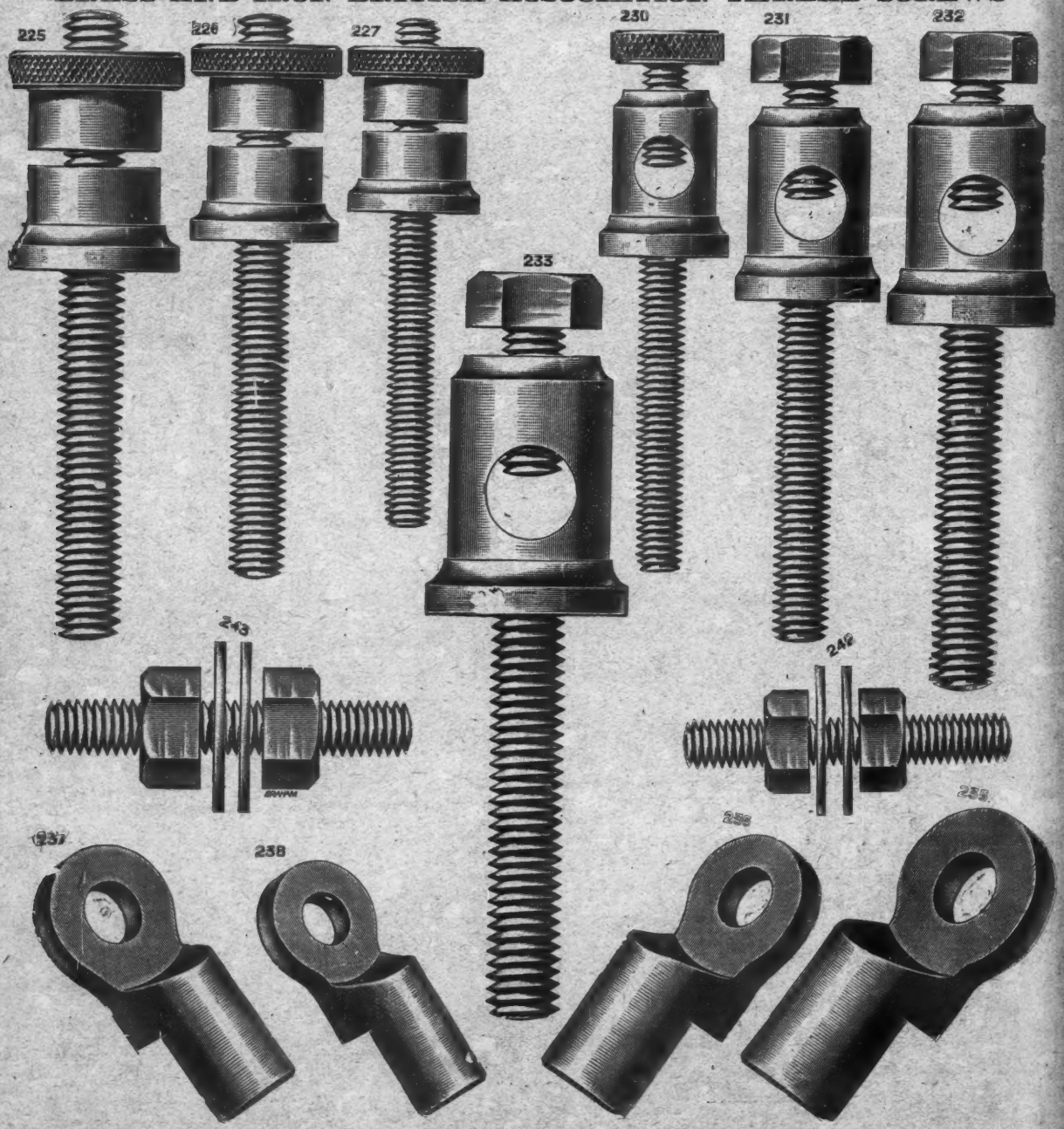

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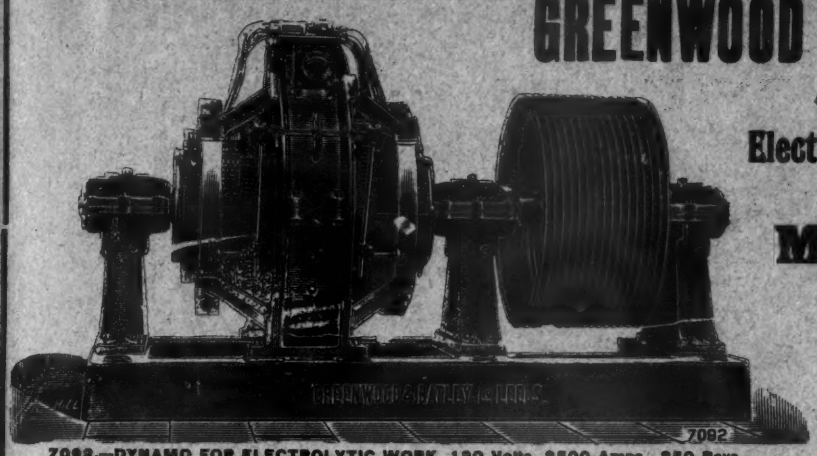

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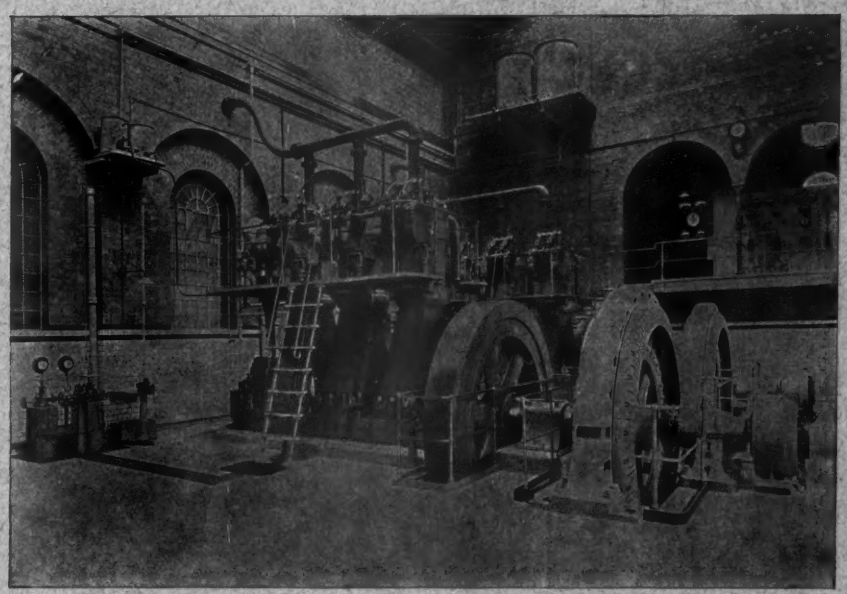

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